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Figure 1

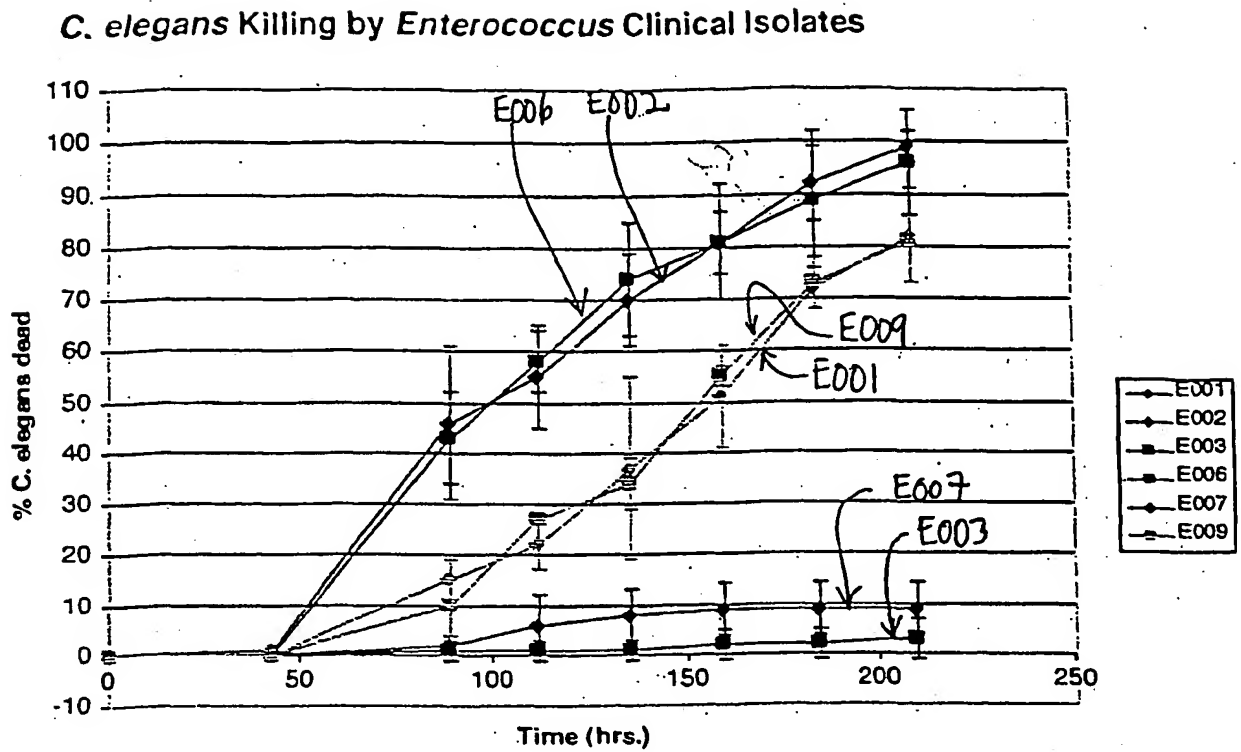
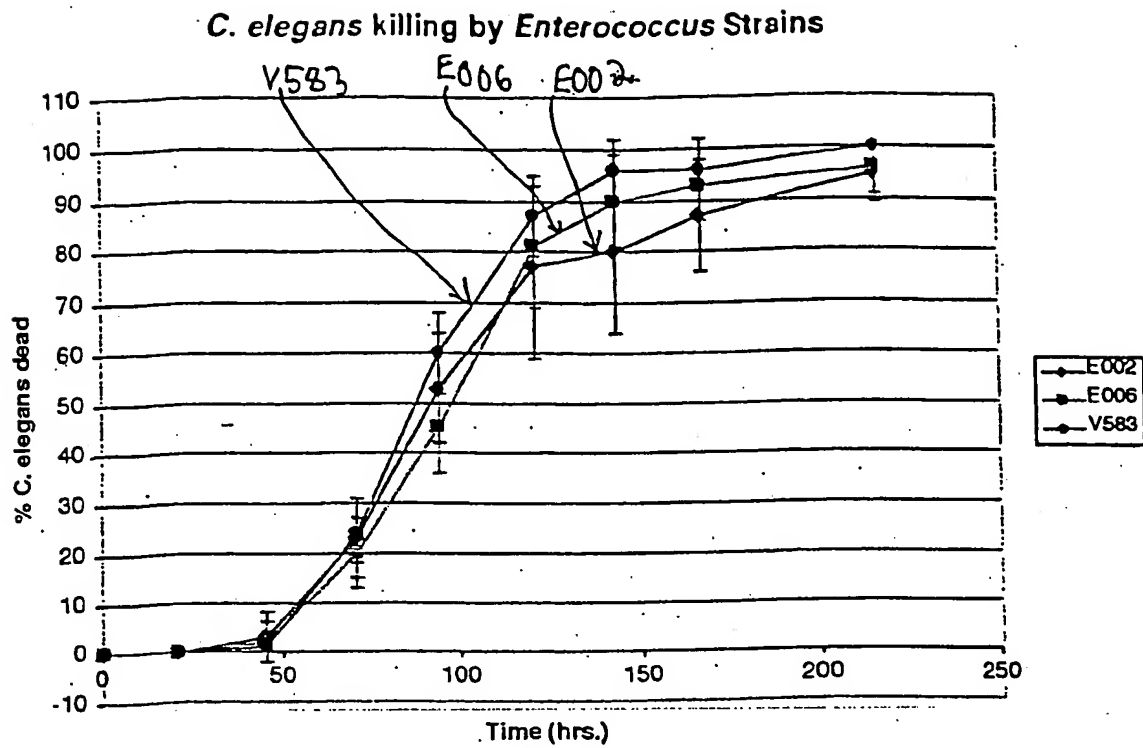


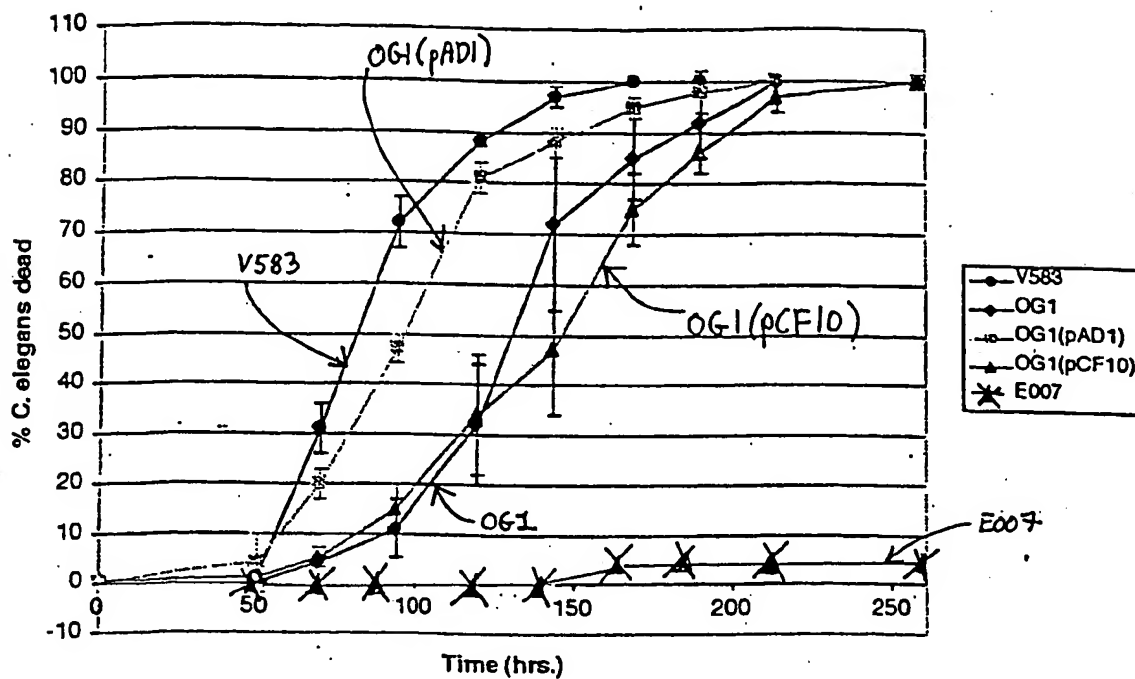
Figure 2



Title: Enterococcal Virulence Factors
Applicant(s): Ausubel et al.
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Figure 3

C. elegans Killing by *Enterococcus* Isogenic Strains



Title: Enterococcal Virulence Factors

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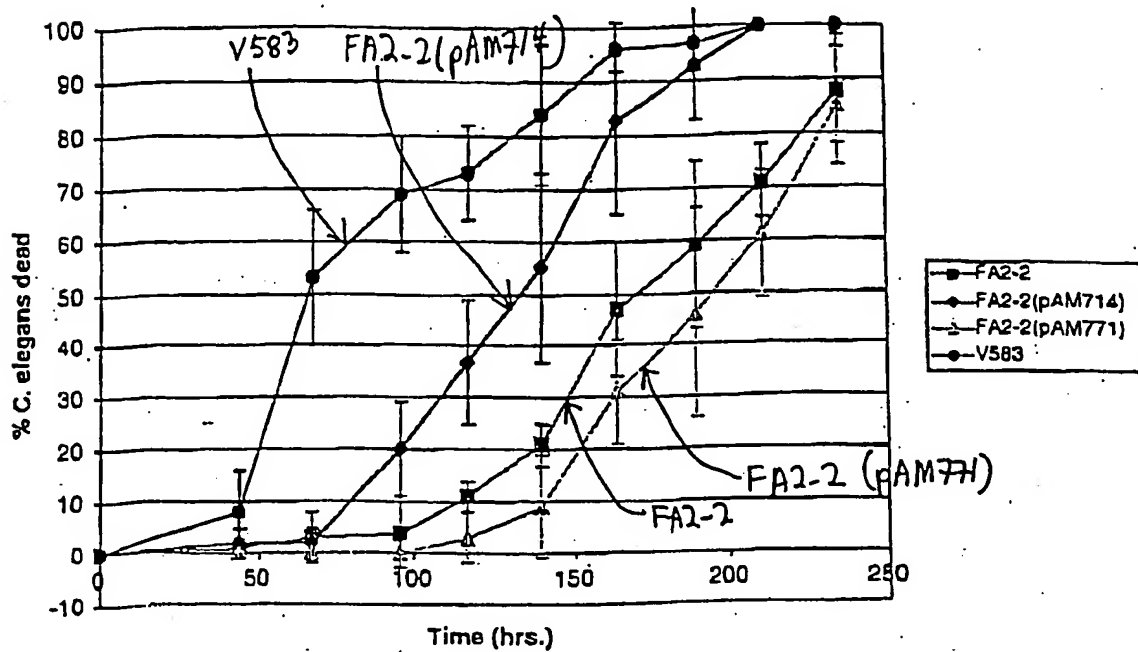
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Figure 4

C. elegans Killing by Isogenic *Enterococcus* Strains Containing Different Conjugative Plasmids: pAD1 vs. pAD1-cyl Δ



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Figure 5A

Photolyase
gaaattgacc gtaaagtcaa tatttacaac attttaagcc tgaatgcgct aggtacgcta 60
tacgaactgg aaaaagatat gagaaaagcg caagtgtatt acgaaaaatc attacaagaa 120
ttggaacaat ttaaattaga atgttccttg gagcgttgta gaatttatta taattctgct 180
aaattctact cggaaatgaa agactaccaa aaaagtgtca ttttaagcga aaaagggatt 240
cagatttgct gtgacaaaca ctccatttat ttgctagatt atcttttata tgaaaaagcc 300
tttaacaaac aaatgctcgg ggaagacaca gccgatgact atcgccaagc ctattatttt 360
acacaatttt ttggcaatac ggaagtcttg caatatattg agaaagatat gaaagctttt 420
aatatttcct attaatttaa tcaaaaagcc gataaaagct gaaaactcag tttttaccgg 480
ctttttgaaa aatataggca agttgctttt aaaaatcagc agtcacgggt acgataagca 540
agacgaagta tttaggagga tttaaaaatg aaaagagtaa tatggtttag acgtgattta 600
cgattacagg ataataaagc attagcacac gcgttacaaa attctgcagc tgatgaattg 660
attttattat tccaaatgaa tcctcaacaa tttattcaag aaagtgtcaa tcataacgct 720
ttttttgcaa gcttagcctc gttcaaagaa cgaatcgatc aagaggcaca tttacaaatc 780
atggtcggcg aaccattaga tttattttca cgtttgaaac gcaaattacc cgattggcag 840
gccattttat ttaatgaaga tacttgtggc tttggggcaa agcgggacca gcaagctatg 900
cgcttttttg aagaaaataa tattcagctt ttctcttttc aagatgccta tttgcatggc 960
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caaaaccagt ctttagttta tctagactgg tttgtcacg tacgttatat aaattatgct 2220
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Figure 5B

Photolyase

Met	Lys	Arg	Val	Ile	Trp	Phe	Arg	Arg	Asp	Leu	Arg	Leu	Gln	Asp	Asn
1				5					10						
Lys	Ala	Leu	Ala	His	Ala	Leu	Gln	Asn	Ser	Ala	Ala	Asp	Glu	Leu	Ile
			20					25					30		
Leu	Leu	Phe	Gln	Met	Asn	Pro	Gln	Gln	Phe	Ile	Gln	Glu	Ser	Ala	Asn
		35					40					45			
His	Asn	Ala	Phe	Phe	Ala	Ser	Leu	Ala	Ser	Phe	Lys	Glu	Arg	Ile	Asp
	50					55					60				
Gln	Glu	Ala	His	Leu	Gln	Ile	Met	Val	Gly	Glu	Pro	Leu	Asp	Leu	Phe
65					70					75					80
Ser	Arg	Leu	Lys	Arg	Lys	Leu	Pro	Asp	Trp	Gln	Ala	Ile	Tyr	Phe	Asn
				85					90					95	
Glu	Asp	Thr	Cys	Gly	Phe	Gly	Ala	Lys	Arg	Asp	Gln	Gln	Ala	Met	Arg
			100					105					110		
Phe	Phe	Glu	Glu	Asn	Asn	Ile	Gln	Ser	Phe	Ser	Phe	Gln	Asp	Ala	Tyr
		115					120					125			
Leu	His	Gly	Ser	Glu	Glu	Ile	Lys	Lys	Asn	Asp	Gly	Ser	Lys	Tyr	Gln
	130					135					140				
Val	Phe	Thr	Pro	Tyr	Tyr	Asn	Lys	Trp	Lys	Glu	Ala	Pro	Lys	Glu	Thr
145					150					155					160
Pro	Ile	Pro	Val	Ser	Tyr	Thr	Ala	Glu	Lys	Ile	Phe	Ser	Ala	Cys	Leu
				165					170					175	
Phe	Pro	Glu	Glu	Ala	Ala	Tyr	Arg	Glu	Gln	Ile	Ala	Arg	Arg	Ile	Pro
			180				185						190		
Leu	Thr	His	Tyr	Ser	Val	Gly	Glu	Glu	Thr	Ala	Arg	Arg	Arg	Leu	Asn
	195						200					205			
Thr	Phe	Ile	Asp	Gln	Lys	Leu	Gln	Ser	Tyr	Glu	Asn	Lys	Arg	Asp	Phe
	210					215					220				
Pro	Tyr	Gln	Asp	Gln	Thr	Ser	His	Leu	Ser	Thr	Phe	Leu	Arg	Thr	Gly
225					230						235				240
Glu	Leu	Ser	Ile	Arg	Thr	Ile	Trp	Gln	Glu	Leu	Ala	Ser	Val	Pro	Ser
				245					250					255	
Ser	Leu	Ser	Lys	Glu	Thr	Phe	Lys	Lys	Glu	Leu	Ala	Trp	Arg	Asp	Phe
			260					265					270		
Tyr	Asn	Met	Ile	Tyr	Ser	Ala	Phe	Pro	Gln	Gln	Lys	Glu	Glu	Ala	Ile
	275						280						285		
Gln	Glu	Lys	Phe	Arg	Tyr	Ile	Gln	Trp	Thr	Asn	Asp	Pro	Glu	Met	Phe
	290					295					300				
Val	Lys	Trp	Gln	Lys	Gly	Glu	Thr	Gly	Tyr	Pro	Ile	Ile	Asp	Ala	Ala
305					310					315					320
Met	Arg	Gln	Leu	Asn	Gln	Thr	Gly	Trp	Met	His	Asn	Arg	Leu	Arg	Met
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Ile	Thr	Ala	Ser	Phe	Leu	Val	Lys	Asn	Leu	His	Ile	Asp	Trp	Arg	Trp
			340					345					350		
Gly	Glu	Lys	Tyr	Phe	Gln	Lys	Met	Leu	Ile	Asp	Tyr	Asp	Ala	Ala	Asn
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Asn	Ile	Gly	Gly	Trp	Gln	Trp	Ala	Ala	Ser	Thr	Gly	Thr	Asp	Ala	Val
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Pro	Tyr	Phe	Arg	Ile	Phe	Asn	Pro	Ile	Ile	Gln	Ser	Lys	Lys	Phe	Asp
385					390					395					400
Asn	Asp	Gly	Gln	Phe	Ile	Lys	Lys	Tyr	Val	Pro	Glu	Leu	Lys	Gln	Val
				405					410					415	
Pro	Gln	Lys	Tyr	Ile	His	Gln	Pro	Asn	Leu	Met	Asn	Glu	Ala	Leu	Gln
			420					425					430		
Thr	Gln	Tyr	His	Val	His	Leu	Gly	Glu	Asn	Tyr	Pro	Lys	Pro	Ile	Val
	435						440					445			
Asp	Tyr	Ala	Ser	Ser	Lys	Lys	Gln	Thr	Leu	Phe	Leu	Tyr	Glu	Ala	Ser
	450					455					460				
Lys	Glu	Ile	His	Gln	Glu	Met	Asn	Asn	Pro	Arg	Phe	Gln			
465					470					475					

Figure 6A

ScrR
 ccttttgaaa atttagatga aggatttgat gtctacgcca ctcaagcctt taatgcgcca 60
 gatggctcgtg cacttgcggt cagttggatt gggttgccag aaatcactta cccaagtgat 120
 gtggagggtt gggcaaatgg cttaaagtctg gttaaagaac tcacaattca caacgggaaa 180
 ctatttcaat atccagtttc tgaaacagaa atgcttcgtc aatccgctac tactttatca 240
 aatggctgcc atttcttata tactgcttct tttgaattag aagtggatat tcccaaaaaat 300
 gagattgctt ttattcggtt tttagcgaac gaaacgggtt caaaaggact ttttaattaca 360
 attgatacga ttcattggtta aataaccctt gatcgaacat ttgctggcca atcttttgct 420
 gaaaagtatg gcacaattcg tgaaactaaa attaggaaaa ataagtcagt tcagttaact 480
 atttttgttg attgctctgt tgcagaaatc tatgtaaata aaggtgaaaa aacgatgact 540
 ggtcgcttct tccagataaa agcgcaacag tatcttcac tatccaagac ggcaaaagct 600
 tgtttttatg agctggaaaa tacgaataat taggaatgat ggtgaatttt gatgggtggt 660
 aaattaacgg atgtagcaaa gcttgctggg gtgagccga caacggtaag ccgctgatt 720
 aataattatg gttatcttag tcaaaaaaca attgataaag ttcattcaagc gatggaagaa 780
 ttaaattatc aacctaatgg attagccaga agcctccaag gaaaaagtac gcagctgatt 840
 ggttttagtct tcccttctgt tagtcatcca ttttttggtg aattaattga aacactggaa 900
 agaaagctct ttgttcaagg atataaagtg attttatgtg atagtgaaaa agatccagaa 960
 aaagagcgcg cctattttacg aatgctcgct gcaataaag tggacgggtg aatcactggt 1020
 agccataact tagctattaa cgaatatgaa aatgtttcac tacctattgt ttcctttgac 1080
 cgttttttgg cacttgcaaa tccaattgtc tcttcgcaaa actttcaagg gggccaaaaa 1140
 gccactgaag ccttatttgc aagtgggtgca caaaagattg caattattac tgggtgcta 1200
 aacacaggcg cacctagcga ttatcgattg gctgggtata aacaaacaat ggaaaaatat 1260
 ggcgcagaaa aaacgattct acaaatgtat aatgggacct caacaacatt aaaaaatcta 1320
 gaaatcgaac gtttgcttca aaataaaaact gtagacggca tcttttgtac agatgatttg 1380
 acagcaatta cagttatgaa tattgctcaa aaattgaaga tatccattcc tgaagaatta 1440
 aaagtaattg gttatgatgg gacaaaatta atcaaaagaa ttgcccaca actatcaacc 1500
 attgtgcagc caatcgacga gatgtgtgac gttatgattg acttactgct tcgtagaatg 1560
 aaggatcctg atgttgcaact tgaggaaaaat tatcctatc cgattcagct atcattgtct 1620
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 aatacaccga gcattagtaa aacataccac caatttttgg cgctataggt ttcattttta 1800
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Figure 6B

ScrR

Met	Val	Val	Lys	Leu	Thr	Asp	Val	Ala	Lys	Leu	Ala	Gly	Val	Ser	Pro
1				5					10					15	
Thr	Thr	Val	Ser	Arg	Val	Ile	Asn	Asn	Tyr	Gly	Tyr	Leu	Ser	Gln	Lys
			20					25					30		
Thr	Ile	Asp	Lys	Val	His	Gln	Ala	Met	Glu	Glu	Leu	Asn	Tyr	Gln	Pro
		35					40					45			
Asn	Gly	Leu	Ala	Arg	Ser	Leu	Gln	Gly	Lys	Ser	Thr	Gln	Leu	Ile	Gly
	50					55					60				
Leu	Val	Phe	Pro	Ser	Val	Ser	His	Pro	Phe	Phe	Gly	Glu	Leu	Ile	Glu
65					70					75					80
Thr	Leu	Glu	Arg	Lys	Leu	Phe	Val	Gln	Gly	Tyr	Lys	Val	Ile	Leu	Cys
			85						90					95	
Asp	Ser	Glu	Lys	Asp	Pro	Glu	Lys	Glu	Arg	Ala	Tyr	Leu	Arg	Met	Leu
			100					105					110		
Ala	Ala	Asn	Lys	Val	Asp	Gly	Val	Ile	Thr	Gly	Ser	His	Asn	Leu	Ala
		115					120					125			
Ile	Asn	Glu	Tyr	Glu	Asn	Val	Ser	Leu	Pro	Ile	Val	Ser	Phe	Asp	Arg
	130					135					140				
Phe	Leu	Ala	Pro	Gly	Ile	Pro	Ile	Val	Ser	Ser	Gln	Asn	Phe	Gln	Gly
145					150					155					160
Gly	Gln	Lys	Ala	Thr	Glu	Ala	Leu	Phe	Ala	Ser	Gly	Ala	Gln	Lys	Ile
			165					170					175		
Ala	Ile	Ile	Thr	Gly	Ala	Asn	Asn	Thr	Gly	Ala	Pro	Ser	Asp	Tyr	Arg
			180					185					190		
Leu	Ala	Gly	Tyr	Lys	Gln	Thr	Met	Glu	Lys	Tyr	Gly	Ala	Glu	Lys	Thr
	195						200					205			
Ile	Leu	Gln	Ile	Asp	Asn	Gly	Thr	Ser	Thr	Thr	Leu	Lys	Asn	Leu	Glu
	210					215					220				
Ile	Glu	Arg	Leu	Leu	Gln	Asn	Lys	Thr	Val	Asp	Gly	Ile	Phe	Cys	Thr
225					230					235					240
Asp	Asp	Leu	Thr	Ala	Ile	Thr	Val	Met	Asn	Ile	Ala	Gln	Lys	Leu	Lys
			245					250					255		
Ile	Ser	Ile	Pro	Glu	Glu	Leu	Lys	Val	Ile	Gly	Tyr	Asp	Gly	Thr	Lys
		260						265					270		
Leu	Ile	Lys	Arg	Ile	Ala	Pro	Gln	Leu	Ser	Thr	Ile	Val	Gln	Pro	Ile
	275						280					285			
Asp	Glu	Met	Cys	Asp	Val	Met	Ile	Asp	Leu	Leu	Leu	Arg	Arg	Met	Lys
	290					295					300				
Asp	Pro	Asp	Val	Ala	Leu	Glu	Glu	Asn	Tyr	Pro	Ile	Pro	Ile	Gln	Leu
305					310					315					320
Ser	Leu	Ser	Glu	Ser	Cys										
				325											

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Figure 7A

OppA

ctgcggcgtg	caagcgattt	tgtttatcac	gctttgtcgg	attgcagggg	taccagccaa	60
atggcaatcg	ggattatatg	tttctacaca	ttatacaggc	tgtcatgatt	gggcacaatt	120
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cgcaaatagt	gagatccagg	cagactttca	gccgggcaaaa	atgcaattgc	gtgcagaccc	300
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caagaggccc	gtagtacagt	tgtacgacca	ggtgtcaaaag	gtattcagta	tcataacttc	2040
gggtgcaacga	gcacatataa	gtatgcctat	aaagaattaaa	ttagtgaaca	aaagtacctt	2100
tagctgaagg	tacttttttt	ccgataagag	cttctttttt	gttaatagtc	aacaattaat	2160
aaaaaaataa	ttgaaaaagg	ttgacaaaaa	taatgatact	cgttagaata	agcactgtta	2220
acaaatgaat	agcgttttca	tgtgactaga	taatactagg	catggaagaa	tttcgtaata	2280
caatgtgggtg	tacaatgggt	acgcaacatg	tttaacggga	ttgttctatg	ctttttttgt	2340
tgttttcact	gaaaaatgta	gaattacttc	tgcaagaagag	ggtcatttat	gaaaattaaa	2400
aaggtgctaa	atcaaaaatgc	tgtacttggt	cttgacgaag	gacaggagaa	agtagctgtc	2460
ggtaaaggcg	tcgggtttta	taagactaaa	aatgatgtct	tatctcgaca	attgggtggag	2520
cggatgtttg	tgatggagcc	agaaggactg	aaaaaacttc	aagtactgct	atcacaaatt	2580
gaagacaaat	acttttttagg	agtgaagaaa	ttatccaaca	tgctgaaacg	gtattgggtg	2640
aaaagttaga	tgaacatatt	aatattgggt	tgagtgatca	cattgctttt	gcagctgaaa	2700
atattcaaaa	taatattatt	gttcggaaca	agcttttaag	tgaaattgag	attttatata	2760
gtgaagaatt	tgctatttgc	caatgggctg	tagaatattt	aacacaaacc	ttagagattc	2820
catttagtta	tgatgaagcg	gggtatattg	cgattcatat	ccatagtgtc	cgcagcgggc	2880
gtactgataa	tagtaaaagt	atccgtgaag	ttacaatcgt	ttctgaaatt	attcatttaa	2940
tcgagcagga	attggctatt	gatattcatg	atgataaaaa	tagtctcagt	tattcacgtt	3000
tggtgaatca	tttacgtttg	tttattcatc	gcttccaaca	aatcaatac	gctgttttag	3060
atga						3064

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Figure 7B

OppA
 Met Lys Lys Leu Lys Met Met Gly Ile Met Leu Phe Val Ser Thr Val
 1 5 10 15
 Leu Val Gly Cys Gly Thr Thr Ala Glu Thr Lys Ile Asp Glu Lys Ala
 20 25 30
 Thr Glu Lys Thr Ser Val Ser Lys Val Leu Asn Leu Met Glu Asn
 35 40 45
 Ser Glu Ile Gly Ser Met Asp Ser Ile Phe Thr Gln Asp Glu Ala Ser
 50 55 60
 Ile Asn Ala Gln Ser Asn Val Phe Glu Gly Leu Tyr Gln Leu Asp Glu
 65 70 75 80
 Lys Asp Gln Leu Ile Pro Ala Ala Ala Lys Glu Met Pro Glu Ile Ser
 85 90 95
 Glu Asp Gly Lys Arg Tyr Thr Ile Lys Leu Arg Glu Asp Gly Lys Trp
 100 105 110
 Ser Asn Gly Asp Ala Val Thr Ala Asn Asp Phe Val Phe Ala Trp Arg
 115 120 125
 Lys Leu Ala Asn Pro Lys Asn Gln Ala Asn Tyr Phe Phe Leu Leu Glu
 130 135 140
 Gly Thr Ile Leu Asn Gly Thr Ala Ile Thr Lys Glu Glu Lys Ala Pro
 145 150 155 160
 Glu Glu Leu Gly Val Lys Ala Leu Asp Asp Tyr Thr Leu Glu Val Thr
 165 170 175
 Leu Glu Lys Pro Val Pro Tyr Phe Thr Ser Leu Leu Ala Phe Ser Pro
 180 185 190
 Phe Phe Pro Gln Asn Glu Ala Phe Val Lys Glu Lys Gly Gln Ala Tyr
 195 200 205
 Gly Thr Ser Ser Glu Met Ile Val Ser Asn Gly Pro Phe Leu Met Lys
 210 215 220
 Asn Trp Asp Gln Ser Ala Met Ser Trp Asp Phe Val Arg Asn Pro Tyr
 225 230 235 240
 Tyr Tyr Asp Lys Glu Lys Val Lys Ser Glu Thr Ile His Phe Glu Val
 245 250 255
 Leu Lys Glu Thr Asn Thr Val Tyr Asn Leu Tyr Glu Ser Gly Glu Leu
 260 265 270
 Asp Val Ala Val Leu Thr Gly Asp Phe Ala Lys Gln Asn Arg Asp Asn
 275 280 285
 Pro Asp Tyr Glu Ala Ile Glu Arg Ser Lys Val Tyr Ser Leu Arg Leu
 290 295 300
 Asn Gln Lys Arg Asn Glu Lys Pro Ser Ile Phe Ala Asn Glu Asn Val
 305 310 315 320
 Arg Lys Ala Leu Ala Tyr Ala Leu Asp Lys Lys Ser Leu Val Asp Asn
 325 330 335
 Ile Leu Ala Asp Gly Ser Lys Glu Ile Tyr Gly Tyr Ile Pro Glu Lys
 340 345 350
 Phe Val Tyr Asn Pro Glu Thr Asn Glu Asp Phe Arg Gln Glu Ala Gly
 355 360 365
 Ala Leu Val Lys Thr Asp Ala Lys Lys Ala Lys Glu Tyr Leu Asp Lys
 370 375 380
 Ala Lys Ala Glu Leu Asn Gly Asp Val Ala Ile Glu Leu Leu Ser Arg
 385 390 395 400
 Asp Gly Asp Ser Asp Arg Lys Val Ala Glu Phe Ile Gln Gly Gln Leu
 405 410 415
 Gln Glu Thr Leu Pro Gly Leu Thr Ile Asn Val Lys Thr Val Pro Leu
 420 425 430
 Asn Asn Ala Ile Glu Leu Met Arg Lys Gly Asp Tyr Glu Leu Ser Val
 435 440 445
 Gly Met Trp Gly Pro Asp Tyr Gln Asp Pro Met Thr Phe Leu Glu Ser
 450 455 460
 Ser Val Ser Gly Asn Arg Met Asn Tyr Ser Ser Pro Thr Phe Asp Gln

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465					470					475				480
Leu	Ile	Glu	Glu	Ala	Thr	Thr	Lys	Tyr	Ala	Asn	Glu	Pro	Glu	Thr Arg
				485					490				495	
Trp	Gln	Thr	Leu	Ile	Lys	Ala	Glu	Lys	Val	Leu	Val	Glu	Glu	Asp Ala
			500					505					510	
Ala	Leu	Ile	Pro	Leu	Tyr	Gln	Glu	Ala	Arg	Ser	Gln	Leu	Val	Arg Pro
		515					520					525		
Gly	Val	Lys	Gly	Ile	Gln	Tyr	His	Asn	Phe	Gly	Ala	Thr	Ser	Thr Tyr
	530					535					540			
Lys	Tyr	Ala	Tyr	Lys	Glu									
545					550									

Fig. 7B
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Figure 8A

TcaA

aatcaatgaa	atttaataaaa	aaagcttagt	tagttgcatt	cattgttcaa	atcggttaca	60
ctaagtaagt	aaaaaaatat	aatacaaggt	tcgtcttcag	gggcagggtg	taattcccga	120
ccggtgggtta	tagtccacga	ctcgttttta	acgattgaat	tggtgtaatt	ccaataccga	180
cagtatagtc	tggataaaga	agatagggct	tatttgagac	gctttttcat	cagataatcc	240
tactctattt	ttccctgcag	aaaaataggg	tttttttgta	tgacaaagaa	gcgaatcaaa	300
aagttcgttg	aagatgggtc	cttaattgga	ggatttcaga	tgaacaacaa	ggtacaaaaa	360
atggtcagca	ttgcaatggt	ggccgcaatc	ggtacagtat	tacaatttgt	ggcatttccg	420
attatgccgg	cgttttagttt	tttgaaaatc	gatcttagtg	atattccgat	tctactcgga	480
atgttcttgt	acggaccgtt	agcaggagta	attactgctt	ttgttcgttc	gttgctacac	540
ctgttcttaa	ccggactagc	accgcaaaat	atggtgggag	atttcgctag	cttttttagca	600
agtagtatct	tcaccttgcc	aattttttat	ttctttggta	aaaagaaaaa	tatccgtaca	660
aatcggatag	tgggcttagt	aagtgggac	ttagccttga	caattttcat	gagtattgcg	720
aattattttg	tcattacacc	catttactta	caattatatg	gtgtgaccac	acaacaattt	780
ttaggaacat	ctttagcaag	ctatgtggcg	attggtattg	tgccattcaa	ccttatttaa	840
ggcctcttag	tcagtgggtg	ttttctagta	ctacatgcga	agttattgcc	atggctatca	900
aaaaaacaac	atactattca	gaaaaaaaaca	ccgttaacaa	aataaatgat	aaaaaacctg	960
ctgttgaaca	atgtttgaca	gtgggttttt	aaaatttacg	cctaaaagaa	aagagggtgt	1020
cataatctgt	catcattctg	ttaaaaaata	ctaaaccatc	tgcatgtgaa	ttttaacttt	1080
cccttggtat	gatagaaatc	atcaaagaaa	gaggagtttt	cctgagttaa	aaagtgtaaa	1140
aattgtcgtc	acgtgaatcg	tgatacggag	tccttttggt	aagaatgcgg	cgctccgcta	1200
atgaatgaat	caatgcatca	agaggaaaac	caagcacaac	catcaatgaa	taaagggaac	1260
gaatctactc	ctctcagatc	aaaaagaagc	tggatctggg	cgtttctttt	tgtgttcac	1320
gttcttggag	cgggtagcta	ttttctcggg	acgcattatt	tttctaagga	acaacaaatt	1380
tcttatttta	ttgaagcgat	tgagaatggt	gatgcccaag	aattaagtaa	aaaaatgagg	1440
acgaacgagt	ctgaatttca	agtgaatccg	caaagcatta	agcctttaat	cacttattat	1500
caaaaaaatc	caactgagct	aaaaaaatta	gaaaaagcgc	tattaaagga	taaaaagtta	1560
catggtttta	ctattcgtga	aacaagtcaa	acagcatttt	tctttcaccg	ttatcaattc	1620
attttaacgc	ctgtttctgt	tcagttaacg	acgaatcagc	gcggtgtgac	gctggcaatg	1680
aacgggcggg	aagtgggcac	ttccgactca	accacttatc	aaaaggaatt	gggcccctta	1740
gcgccaggac	aatatacttt	tacagccaca	gtgaaagata	gcaccggcga	acctgttatc	1800
acagaagagt	accgtttatt	agaagaggaa	aatttatatt	ctagtattcc	tttagatttt	1860
aaacgaatga	attttggtgt	ggaaagcaat	ctgccagacg	cagatattta	tattaatgat	1920
cggaaagttg	gtacgctaac	gaatggaagc	aaaacgattg	gccctttggt	ctggtccaaa	1980
gggatgacga	ttcaacttaa	aaagacgatt	aatggagaag	aaattcaaac	atcaaaagaa	2040
acgattgggt	aaaaatgattt	tgtcgaagcg	ctctccgata	atccaacgct	acaattgaat	2100
tttccgttag	ctagcgacta	tgatgcccg	aaagcgctag	aaacctttta	tcaagcattt	2160
gccaaacaag	tgaaaagtca	tacggatagt	acagaatttg	ctaaaaaata	tctcgttggt	2220
ggggaaaata	atcttcaatt	tccttctttt	atagaagcac	ttgaacgatt	acgtgaaaag	2280
aaatcgaccg	atggttcacc	agattttgaa	gtgaccatta	atacgttaca	attggatggt	2340
aaagaaaatt	accatgtcaa	ttattattta	gaagccaaaa	attctaaagc	aaaagaaaat	2400
ggtcttcgtt	atgaatggat	caatggccta	aatgatcaaa	ttcatttagt	caaagaaccg	2460
ttaaaagaag	gacaattaca	gtttgtttcg	atagatgaac	aaacacttgc	ttggctcgaa	2520
aagatactct	aggcaaaaat	gagtgtctaa	ttatttagca	ctcatttttg	cttatttcta	2580
ttgcacgcgt	gggacatttg	cgttacgctt	ttaacacatt	ctcgcgttcg	ttttctggaa	2640
taaattggtg	tcgagcatgc	ggctcgtctt	taaaaaggac	aatcccatga	tcatcataat	2700
caaatatatt	aggcgcataa	acttgacaaa	gtccacaagc	aatacatttt	tcaggaacta	2760
aacgtgattg	cataaacagt	gacacatcct	atctaaaaga	ggtttactat	ggaagcaact	2820
tttatttttag	cgtttattatc	tcattggatac	aaggtacgtg	catcaacttt	gtatcatctt	2880
ttaaaaggca	aacggactag	ctctgttttg	atztatggtt	ttttatatga	ttgtttacgg	2940
ttcattggct	ggtggccaac	gatttccgaa	caagcctatt	ttcaatttct	tgaaaaactt	3000
tcgaaggcga	aacaaattca	gtatcacgaa	gagacaaatg	agattcaact	aacaaaagaa	3060
gggcaactat	ttttaaaagga	gcaccatttt	tcggtgctgg	attatcctgc	aattgatctt	3120
tatcgttttg	gcagaagtga	tcgagaaaag	tggcaactca	ttcaatttgc	cgtgcaagtg	3180
acttcatatt	tatcatttga	ggaaaaacag	tatatccac	ttttatcaac	accgatttccg	3240
caactatatt	tgaaacgatg	gttacaacaa	gacaagaaag	agcagcgcgt	tcaatcaatc	3300
aaagaagaac	tgttgcgagg	gtttgagtta	ctacctgaag	cagaaagcga	ctatttggtt	3360
gcgcaacttt	ctggttatca	gcaaactggc	aaagttcctc	agcaattaac	aagccataag	3420
acagctcttg	aacagcgttt	gtggcacacg	caagcggttc	atcatttact	gcagttgata	3480

atgtacggag gaaattat

Figure 8A
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Figure 8B

Tcaa

Met	Asn	Glu	Ser	Met	His	Gln	Glu	Glu	Asn	Gln	Ala	Gln	Pro	Ser	Met
1				5					10					15	
Asn	Lys	Gly	Asn	Glu	Ser	Thr	Pro	Leu	Arg	Ser	Lys	Arg	Ser	Trp	Ile
			20					25					30		
Trp	Ala	Phe	Leu	Phe	Val	Phe	Ile	Val	Leu	Gly	Ala	Gly	Ser	Tyr	Phe
	35						40					45			
Leu	Gly	Thr	His	Tyr	Phe	Ser	Lys	Glu	Gln	Gln	Ile	Ser	Tyr	Phe	Ile
	50					55					60				
Glu	Ala	Ile	Glu	Asn	Gly	Asp	Ala	Gln	Glu	Leu	Ser	Lys	Lys	Met	Arg
65					70					75					80
Thr	Asn	Glu	Ser	Glu	Phe	Gln	Val	Asn	Pro	Gln	Ser	Ile	Lys	Pro	Leu
				85					90					95	
Ile	Thr	Tyr	Tyr	Gln	Lys	Asn	Pro	Thr	Glu	Leu	Lys	Lys	Leu	Glu	Lys
			100					105					110		
Ala	Leu	Leu	Lys	Asp	Lys	Lys	Leu	His	Gly	Leu	Thr	Ile	Arg	Glu	Thr
	115						120					125			
Ser	Gln	Thr	Ala	Phe	Phe	Phe	His	Arg	Tyr	Gln	Phe	Ile	Leu	Thr	Pro
	130					135					140				
Val	Ser	Val	Gln	Leu	Thr	Thr	Asn	Gln	Arg	Gly	Val	Thr	Leu	Ala	Met
145					150					155					160
Asn	Gly	Arg	Glu	Val	Gly	Thr	Ser	Asp	Ser	Thr	Thr	Tyr	Gln	Lys	Glu
			165						170					175	
Leu	Gly	Pro	Leu	Ala	Pro	Gly	Gln	Tyr	Thr	Phe	Thr	Ala	Thr	Val	Lys
			180					185						190	
Asp	Ser	Thr	Gly	Glu	Pro	Val	Ile	Thr	Glu	Glu	Tyr	Arg	Leu	Leu	Glu
		195					200					205			
Glu	Glu	Asn	Tyr	Ile	Ser	Ser	Ile	Pro	Leu	Asp	Phe	Lys	Arg	Met	Asn
	210					215					220				
Phe	Val	Val	Glu	Ser	Asn	Leu	Pro	Asp	Ala	Asp	Ile	Tyr	Ile	Asn	Asp
225					230					235					240
Arg	Lys	Val	Gly	Thr	Leu	Thr	Asn	Gly	Ser	Lys	Thr	Ile	Gly	Pro	Leu
			245						250					255	
Phe	Trp	Ser	Lys	Gly	Met	Thr	Ile	Gln	Leu	Lys	Lys	Thr	Ile	Asn	Gly
			260					265					270		
Glu	Glu	Ile	Gln	Thr	Ser	Lys	Glu	Thr	Ile	Gly	Glu	Asn	Asp	Phe	Val
		275					280						285		
Glu	Ala	Leu	Ser	Asp	Asn	Pro	Thr	Leu	Gln	Leu	Asn	Phe	Pro	Leu	Ala
	290					295					300				
Ser	Asp	Tyr	Asp	Ala	Arg	Lys	Ala	Leu	Glu	Thr	Phe	Tyr	Gln	Ala	Phe
305					310					315					320
Ala	Lys	Gln	Val	Lys	Ser	His	Thr	Asp	Ser	Thr	Glu	Phe	Ala	Lys	Lys
			325						330					335	
Tyr	Leu	Val	Gly	Glu	Asn	Asn	Pro	Gln	Phe	Pro	Ser	Phe	Ile	Glu	
			340				345					350			
Ala	Leu	Glu	Arg	Leu	Arg	Glu	Lys	Lys	Ser	Thr	Asp	Gly	Ser	Pro	Asp
		355					360					365			
Phe	Glu	Val	Thr	Ile	Asn	Thr	Leu	Gln	Leu	Asp	Gly	Lys	Glu	Asn	Tyr
	370					375					380				
His	Val	Asn	Tyr	Tyr	Leu	Glu	Ala	Lys	Asn	Ser	Lys	Ala	Lys	Glu	Asn
385					390					395					400
Gly	Leu	Arg	Tyr	Glu	Trp	Ile	Asn	Gly	Leu	Asn	Asp	Gln	Ile	His	Leu
			405						410					415	
Val	Lys	Glu	Pro	Leu	Lys	Glu	Gly	Gln	Leu	Gln	Phe	Val	Ser	Ile	Asp
			420					425					430		
Glu	Gln	Thr	Leu	Ala	Trp	Leu	Glu	Lys	Ile	Leu					
		435					440								

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Figure 9A

ScrB

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aatttagata attgacgccg gccgcttcgg caactgtgac aatatcaaag ccagcaaaaag 60
ctttttcttt taattcgctc agaaagtcac tcattcctgg catgtttcta ctagcttttg 120
ttactttggc taattgatct gcccacacag caggtaagtt tgtccaagtc aaatctttct 180
taataaaatt aatcgcatct acacgaaaac cagcaattcc tttgtttaac caaaaacgaa 240
tcatttgata gatttctttg cgtagttcag gattttccca atttaaatec ggctgttttt 300
tatgaaaggc atgaaagtag taggcatctt cccaggttaa tttttcccaa acactaccac 360
cgaagttaga cgcgcaattt gtaggtgctt ctcgctcttc ttttataata taaaagtctc 420
gaaaacgact ttgaggattt tttaaaacat cttgaaacca agcatgttca tcagatgtat 480
ggtttaccac caaatctaaa ataactttta tgtttcgttt ttttgcttct tcaatgagtt 540
catcgaagtc tgccattgta ccaaaatcgc tagaaatacc ataatagtct gaaatatcat 600
atccattgtc agccattggc gacgggtaca ttggactcag ccaaatcagc gtaattccta 660
aattttctaa gtaatccagt ttttgaataa tgccttgtaa atcaccaatt ccgtcattat 720
tactatccga aaagctacgt ggataaattt gataggccac ttctttttgc caccaatttc 780
tggtcattct gggtctcctc actcttaaac tagtctgtt aattttttct gtaaccgttt 840
ttacattttg tatgatactc gtttttgcgt aatatgtcaa acgtttatca taaataaatg 900
taaattataa tattcttttg atttaaatag atttatatat gttatacgtt tgactttttt 960
ctgatttggt tatactatta gactaactac tattttctaa taaaggagac attacttttg 1020
tcaagcatca tgaaccaatg gacggatgaa ttacgttatg cgccttattc ttcttggaca 1080
tctgtcacc tcgaaaatct aacttctatt atcgcgcaat ctagttggcg ttttaagtat 1140
catattcaac cacagacagg actactaaat gatcccaacg gtttttcgta tttcaataac 1200
cagtggcatt tattttatca agcgtttcct ttccggagtg ttcacggact aaaaagttgg 1260
gccacttaa cttcctccga ctttaattcac tgggattatg aagggaattgc cctttatccc 1320
gactctgaat atgattctca tggcgctctat tcaggctcag ctttaacaat agataaccaa 1380
ctatgtttat tttatacagg aaatgttcgt gatcaaaact ggcaacgatt tgcataatcaa 1440
aatattgcat ggctgaattc tttaggtgcg atcacaaggg aatcaacacc attcctacct 1500
attgacccca attattcttc ccattttcgt gatccgatgg tatttcctta tcaagaagga 1560
cttgttttat taattgggtc tagtgattta aatggacaag gaaaaattgt ggtctatttt 1620
tctaaagatc gaaatgtaca caattttcat caacttggcg aattgacgtt caccaaccaa 1680
gaattaggct acatggttga atgccccaat ttggtattta ttgatggcca gcctgtctta 1740
ttattttgcc cacaaggtct atctccatct gtaaaaagtt atcagaatat ctatccgaat 1800
atgtacacat tggccgaaac gtttgatttg gagaatcttt ctttagttca ggctgggcct 1860
tttgaaaatt tagatgaagg atttgatgtc tacgccactc aagcctttaa tgcgccagat 1920
ggctgtgcac ttgcggtcag ttggattggg ttgccagaaa tcacttacc aagtgatgtg 1980
gagggttggg caaatggctt aagtctgggt aaagaactca caattcacaa cgggaaacta 2040
tttcaatata cagtttctga aacagaaatg cttcgtcaat ccgctactac tttatcaaat 2100
ggctgccatt tcttatctac tgcttctttt gaattagaag tggatattcc caaaaatgag 2160
attgctttta ttcggtttt agcgaacgaa acgggttcaa aaggactttt aattacaatt 2220
gatacgattc atggtaaaat aacccttgat cgaacatttg ctggccaatc ttttgctgaa 2280
aagtatggca caattcgtga aactaaaaat aggaaaaata agtcagttca gtttaactatt 2340
tttggtgatt gctcgtttgc agaaaatctat gtaaaataag gtgaaaaaac gatgactggg 2400
cgcttctttc cagataaagc gcaacagtat cttcatctat ccaagacggc aaaagcttgt 2460
ttttatgagc tggaaaatac gaataattag gaatgatggg gaattttgat ggtgggttaa 2520
ttaacggatg tagcaaagct tgctggggtg agcccgacaa cggtaagccg cgtgattaat 2580
aattatgggt atcttagtca aaaaacaatt gataaagttc atcaagcgat ggaagaatta 2640
aattatcaac ctaatggatt agccagaagc ctccaaggaa aaagtacgca gctgattggg 2700
ttagtcttcc cttctgttag tcatccattt ttggtgaat taattgaaac actggaaaga 2760
aagctctttg ttcaaggata taaagtgtat ttatgtgata gtgaaaaaga tccagaaaaa 2820
gagcgcgcct atttacgaat gctcgtgca aataaagtgg acggtgtaat cactggtagc 2880
cataacttag ctattaacga atatgaaaat gtttcactac ctattgtttc ctttgaccgt 2940
ttcttggcac ctggcattcc aattgtctct tcgcaaaact ttcaagggg ccaaaaagcc 3000
actgaagcct tatttgcaag tgggtgcacaa aagattgcaa ttattactgg tgctaataac 3060
acaggcgcac ctagcgatta tcgattggct ggttataaac aaacaatgga aaaatatggc 3120
gcagaaaaaa atgtgataat aattgataat gggaccctca caacattaaa aaatctagaa 3180
atcgaacggt tgcttcaaaa taaaactgta gacggcatct tttgtacaga tgatttgaca 3240
gcaattacag ttatgaatat tgctcaaaaa ttgaagatat ccattcctga agaattaaaa 3300
gtaattgggt atgatgggac aaaattaatc aaaagaattg cccacaact atcaaccatt 3360
gtgcagccaa tcgacgagat gtgtgacggt atgattgact 3400

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Figure 9B

ScrB
 Met Ser Ser Ile Met Asn Gln Trp Thr Asp Glu Leu Arg Tyr Ala Pro
 1 5 10 15
 Tyr Ser Ser Trp Thr Ser Ala His Leu Glu Asn Leu Thr Ser Ile Ile
 20 25 30
 Ala Gln Ser Ser Trp Arg Phe Lys Tyr His Ile Gln Pro Gln Thr Gly
 35 40 45
 Leu Leu Asn Asp Pro Asn Gly Phe Ser Tyr Phe Asn Asn Gln Trp His
 50 55 60
 Leu Phe Tyr Gln Ala Phe Pro Phe Gly Ser Val His Gly Leu Lys Ser
 65 70 75 80
 Trp Ala His Leu Thr Ser Ser Asp Leu Ile His Trp Asp Tyr Glu Gly
 85 90 95
 Ile Ala Leu Tyr Pro Asp Ser Glu Tyr Asp Ser His Gly Val Tyr Ser
 100 105 110
 Gly Ser Ala Leu Thr Ile Asp Asn Gln Leu Cys Leu Phe Tyr Thr Gly
 115 120 125
 Asn Val Arg Asp Gln Thr Trp Gln Arg Phe Ala Tyr Gln Asn Ile Ala
 130 135 140
 Trp Leu Asn Ser Leu Gly Ala Ile Thr Lys Glu Ser Thr Pro Phe Leu
 145 150 155 160
 Pro Ile Asp Pro Asn Tyr Ser Ser His Phe Arg Asp Pro Met Val Phe
 165 170 175
 Pro Tyr Gln Glu Gly Leu Val Leu Leu Ile Gly Ala Ser Asp Leu Asn
 180 185 190
 Gly Gln Gly Lys Ile Val Val Tyr Phe Ser Lys Asp Arg Asn Val His
 195 200 205
 Asn Phe His Gln Leu Gly Glu Leu Thr Phe Thr Asn Gln Glu Leu Gly
 210 215 220
 Tyr Met Val Glu Cys Pro Asn Leu Val Phe Ile Asp Gly Gln Pro Val
 225 230 235 240
 Leu Leu Phe Cys Pro Gln Gly Leu Ser Pro Ser Val Lys Ser Tyr Gln
 245 250 255
 Asn Ile Tyr Pro Asn Met Tyr Thr Leu Ala Glu Thr Phe Asp Leu Glu
 260 265 270
 Asn Leu Ser Leu Val Gln Ala Gly Pro Phe Glu Asn Leu Asp Glu Gly
 275 280 285
 Phe Asp Val Tyr Ala Thr Gln Ala Phe Asn Ala Pro Asp Gly Arg Ala
 290 295 300
 Leu Ala Val Ser Trp Ile Gly Leu Pro Glu Ile Thr Tyr Pro Ser Asp
 305 310 315 320
 Val Glu Gly Trp Ala Asn Gly Leu Ser Leu Val Lys Glu Leu Thr Ile
 325 330 335
 His Asn Gly Lys Leu Phe Gln Tyr Pro Val Ser Glu Thr Glu Met Leu
 340 345 350
 Arg Gln Ser Ala Thr Thr Leu Ser Asn Gly Cys His Phe Leu Ser Thr
 355 360 365
 Ala Ser Phe Glu Leu Glu Val Asp Ile Pro Lys Asn Glu Ile Ala Phe
 370 375 380
 Ile Arg Leu Leu Ala Asn Glu Thr Gly Ser Lys Gly Leu Leu Ile Thr
 385 390 395 400
 Ile Asp Thr Ile His Gly Lys Ile Thr Leu Asp Arg Thr Phe Ala Gly
 405 410 415
 Gln Ser Phe Ala Glu Lys Tyr Gly Thr Ile Arg Glu Thr Lys Ile Arg
 420 425 430
 Lys Asn Lys Ser Val Gln Leu Thr Ile Phe Val Asp Cys Ser Val Ala
 435 440 445
 Glu Ile Tyr Val Asn Lys Gly Glu Lys Thr Met Thr Gly Arg Phe Phe
 450 455 460
 Pro Asp Lys Ala Gln Gln Tyr Leu His Leu Ser Lys Thr Ala Lys Ala

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465

470

475

480

Cys Phe Tyr Glu Leu Glu Asn Thr Asn Asn
485 490

Fig. 9B
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Figure 10A

RecQ

ccgcggctgt	gggtgtatcg	ggattggcga	gcgcaagaag	cgacgcttcc	ttatttagat	60
tttcggttat	atcaaatcca	acaaatttgg	caagaaaagg	agtgagtgtt	gttgacatta	120
gaacaagaat	tattcactca	atttggttac	gcagcgttta	agcctggtca	aaaagaagtg	180
attacaaact	tacttgacgg	tattgaataca	ttggctgttt	tgccaacagg	gactggaaaa	240
tcattgtgtt	atcaatttgt	gggccagaag	ttagagggac	taacggtaat	tgtttctccc	300
ttactttcgt	taatggaaga	tcagatgcgt	caattacaaa	gacaaggaat	taaagggtgcg	360
gttgcccttaa	acagtacggt	acagtattca	gaaaagcggt	atatttttagc	gaaaatgttc	420
caatacagatt	atctgttttt	aagcccagaa	atgcttttgc	agcaagaagt	acttagtgtg	480
ttacaacgcc	aaaaaattgc	attattttgtg	gtggatgaag	ccatttgtgt	ttatcagtgg	540
ggcgtcgatt	ttcgccctga	atatagtaaa	ttagatctgg	tccaaaaaca	gctagacttt	600
cctttgacct	tggcggttaac	tgccacagcg	acaccggtg	tacagcacgc	aattataaaa	660
caattatttt	ctcatggcag	ctatcaagaa	gttcttttctt	cagtgaatcg	aaaaaatatt	720
ggcttggtcg	tgaaggaaac	gtcagaaaaa	gaagaagtgt	tactagatta	cttatctaaa	780
acggctggta	aaatcattat	ctattgcgcc	acgcgcaaca	aaacagaaca	aatcagtcaa	840
cttattcagg	caaaaaccag	ttttaaggta	gcctattatc	atgggggctt	ggaggctagt	900
gaacgtagtc	gcttgcaaga	acaatttatt	gataatcaaa	tcgatattct	ttgtgcaacg	960
aatgcttttg	ggatgggaat	cgacaaacct	gatgttcgtg	gagtgattca	ttttgatttg	1020
cctgatagct	tagaaaatta	cctgcaagaa	atcgggagag	ctggacgtga	tggtcaaaaa	1080
agttgggcgc	tattattgta	taaaaaaggg	gatgaattta	ttcatcggtt	tttcttagaa	1140
gagacaagag	cgaatcgagc	gaccttaaaa	tcgctgattg	aaggagaaga	acaagcaggt	1200
ttgctagaaa	atgccaccga	gttacaacaa	aaatgggtcc	aaggctatct	agccaaggat	1260
tattcttttg	aagagctaga	gcacgtttta	gaggagaaag	aaaaagatcg	ccaagcacaa	1320
ttaagagggg	tgctgacgta	tattgaaacc	acaacctgtc	gaagaacgtt	gattcaaaact	1380
tattttcaag	aaccgattgt	caaacaatca	ccggaaactt	gttgtgataa	ttgtgcgtta	1440
ttctttgaca	tttaccaga	ttcaatagta	aaatcgaaca	agaccagcaa	tcaaaatgaa	1500
gaaggttggc	gttctaaatt	tctaaaatta	tttaagaac	gtgatttaatt	cattttttta	1560
gtcggcagtt	ggcaaaaagct	atgatataat	aacaagcgag	agaagttag	gaggaaatta	1620
gcagtgaagta	aaaaggacaa	aaagaaaaac	caagctcggtg	agccatggga	acaatcaatt	1680
tatgaacctg	atcaaaaatgg	tggtgggtct	cgtttagcaa	aacgccaaca	gcaacgagga	1740
aattcattat	ttctaactgt	tttagttatt	ttgctattat	taattattgc	cattccaatt	1800
gggactttct	tatggatgat	gcaagacaag	aaaccgaacg	aaagtgtctag	caaaaatagc	1860
cagccatctt	cttcattagt	ccaatcatca	tcaaaagaga	agaaaaaaga	aagtacgtca	1920
aaatcagtgg	aaagctcaga	accagcaagc	agccaaccag	ctgaaaaatac	aacaccttca	1980
agttcagatg	ctgctgcaca	gcaacaacag	gaccaacaag	cacaacaaca	gcaacagcaa	2040
caacaagagc	agcaacaaca	acaagaagct	caaaatcaac	aacagcaac		2089

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Figure 10B

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RecQ
Met Asn Thr Leu Ala Val Leu Pro Thr Gly Thr Gly Lys Ser Leu Cys
 1      5      10      15
Tyr Gln Phe Val Gly Gln Lys Leu Glu Gly Leu Thr Val Ile Val Ser
 20      25      30
Pro Leu Leu Ser Leu Met Glu Asp Gln Met Arg Gln Leu Gln Arg Gln
 35      40      45
Gly Ile Lys Gly Ala Val Ala Leu Asn Ser Thr Leu Gln Tyr Ser Glu
 50      55      60
Lys Arg Tyr Ile Leu Ala Lys Met Phe Gln Tyr Asp Tyr Leu Phe Leu
 65      70      75      80
Ser Pro Glu Met Leu Leu Gln Gln Glu Val Leu Ser Val Leu Gln Arg
 85      90      95
Gln Lys Ile Ala Leu Phe Val Val Asp Glu Ala His Cys Val Tyr Gln
100      105      110
Trp Gly Val Asp Phe Arg Pro Glu Tyr Ser Lys Leu Asp Leu Val Gln
115      120      125
Lys Gln Leu Asp Phe Pro Leu Thr Leu Ala Leu Thr Ala Thr Ala Thr
130      135      140
Pro Val Val Gln His Ala Ile Ile Lys Gln Leu Phe Ser His Gly Ser
145      150      155      160
Tyr Gln Glu Val Leu Ser Ser Val Asn Arg Lys Asn Ile Gly Leu Phe
165      170      175
Val Lys Glu Thr Ser Glu Lys Glu Glu Val Leu Leu Asp Tyr Leu Ser
180      185      190
Lys Thr Ala Gly Lys Ile Ile Ile Tyr Cys Ala Thr Arg Asn Lys Thr
195      200      205
Glu Gln Ile Ser Gln Leu Ile Gln Ala Lys Thr Ser Phe Lys Val Ala
210      215      220
Tyr Tyr His Gly Gly Leu Glu Ala Ser Glu Arg Ser Arg Leu Gln Glu
225      230      235      240
Gln Phe Ile Asp Asn Gln Ile Asp Ile Leu Cys Ala Thr Asn Ala Phe
245      250      255
Gly Met Gly Ile Asp Lys Pro Asp Val Arg Gly Val Ile His Phe Asp
260      265      270
Leu Pro Asp Ser Leu Glu Asn Tyr Leu Gln Glu Ile Gly Arg Ala Gly
275      280      285
Arg Asp Gly Gln Lys Ser Trp Ala Leu Leu Leu Tyr Lys Lys Gly Asp
290      295      300
Glu Phe Ile His Arg Phe Phe Leu Glu Glu Thr Arg Ala Asn Arg Ala
305      310      315      320
Thr Leu Lys Ser Leu Ile Glu Gly Glu Glu Gln Ala Gly Leu Leu Glu
325      330      335
Asn Ala Thr Glu Leu Gln Gln Lys Trp Val Gln Gly Tyr Leu Ala Lys
340      345      350
Asp Tyr Ser Phe Glu Glu Leu Glu His Arg Leu Glu Glu Lys Glu Lys
355      360      365
Asp Arg Gln Ala Gln Leu Arg Gly Met Leu Thr Tyr Ile Glu Thr Thr
370      375      380
Thr Cys Arg Arg Thr Leu Ile Gln Thr Tyr Phe Gln Glu Pro Ile Val
385      390      395      400
Lys Gln Ser Pro Glu Thr Cys Cys Asp Asn Cys Ala Leu Phe Phe Asp
405      410      415
Ile Tyr Gln Asp Ser Ile Val Lys Ser Asn Lys Thr Ser Asn Gln Asn
420      425      430
Glu Glu Gly Trp Arg Ser Lys Phe Leu Lys Leu Phe Lys Glu Arg Asp
435      440      445

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Figure 11A

LysR

tacttttagct	tctcaaaaagc	tccatacgag	tcaaccttat	ttaagtaccc	agctcaagga	60
gttggaacgt	gaattaggtg	cttcattaat	tttaagagac	aagaaacatt	gtcggctttc	120
tccagcaggc	gaagtcgtcg	ccaagcgaa	agaaatgatt	tttgactca	ttaaggaagc	180
gcaagaagag	attaatgaat	tagtgacca	aggatcgaca	acgaccattc	ggattggaac	240
aaacttaatt	gatatagata	aagcatttgg	agaagtcttg	ttgttattta	atcaatccta	300
tccgtatgta	agtattgatt	tttaagtatta	ttacgatctt	gaaacagcct	tggaaacaga	360
tttaattgac	attgggattg	ggatattttt	ggatacctcg	attccattag	agaaagaatt	420
aattttatata	gaaagctatc	tcctttgtgt	caataaaaaat	catccttttag	cccatgccga	480
tagcgtgacg	attgacgaaa	ttcgttcttt	accttttgct	gcataattccg	atcaagtata	540
tgaaaaaaaaa	gtgttcaaac	gttggaacg	taaaatcaat	tgggaaaatc	ggcaaatcgt	600
catcgaactt	ccttctcttc	atttagtctt	agacatgggc	caacgagaaa	aagcctgtag	660
catccttccc	tattcaactca	ctgatgaact	aaacagacgt	aacttagttg	gtattcctct	720
ggaagatagt	ccagaacgag	ccatctatct	agttcagaat	aatcatcacg	gacattgtga	780
agcacaccgt	tattttattcg	aacaattacg	ttattttattc	taggaataga	aaaaggagga	840
attcccattgg	aactattttcg	tttacattat	tttttagagt	tatgcaaagt	gaaacaattt	900
actaaagcag	ccgaaaattt	agcaatttct	caagctgcat	taagtaagca	aataaaaaatt	960
cttgaagcaa	cgttaggcgc	ggaacttttt	attcgccaag	gccaaactac	caccttaacg	1020
ccagctggat	taatttttaga	aaaatattgt	tggcgcatca	ccaatgagtt	ggtctcaatt	1080
gaagaagagc	taaaagaaat	taatcattct	tccaaccata	tttatgtggc	cacttatctc	1140
tgtgatttag	aatataaatt	gaatgactta	ctaatagcaa	cattaacgga	tcgttcatcc	1200
aacttacaag	tccacactat	tattacagaa	aatattcttc	aatccttgga	aacaatggat	1260
gcagattttg	gtatttccct	tgttgactta	ccattacctg	aacatattgg	taaaattgat	1320
ttattttacag	caaattatca	attcatttta	agaaacgac	atccagcttt	ggcaaaaagc	1380
acgacggaag	aaatttttaaa	agaactaaca	atgtaccctt	tcgtccgttt	aaataccgaa	1440
ttttccgagc	aaaacaaatt	aaccaattgg	ctagatacta	cgttttctaa	tttttctcca	1500
gagaaagtca	ttcaagtgga	tactctttca	cttattactc	acttggtgtc	tcattccgat	1560
agtttcgcta	ttgtccccga	atacaciaat	attcaacttt	tagacaattc	gatccataca	1620
ctaacttacc	aagaactacc	taaaacgaa	atggcagttt	attattttaa	agaacgttac	1680
atgagtcgac	aacttcaaca	acttttggct	gaatgccaaa	aacaatttca	atagtaaaaa	1740
ccaagactag	agcttgtcgg	caagcgagtt	ccagtcttgg	tttttatttg	tgttttcagg	1800
tagcggcttc	tcttcttttg	acaaatccta	aagaagtgat	agccatcact	aacgaagtgc	1860
ctccttgact	taaaaacgga	agcggaatac	cttttaacgg	caacagtcca	atcaccgcac	1920
cgatattctc	caccgtttga	aagaccagcg	aaaaaatgag	ggcgacacag	atgtacatac	1980
aaaaacgcga	attgctccgc	aagccagcta	ctaaaacttg	ataaaacaag	taaaaataga	2040
gaaaaacaac	ggtggcactg	cccacaaagc	cccaggcttc	cccagataaaa	gtaaaa	2096

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Figure 11B

LysR

Met	Glu	Leu	Phe	Arg	Leu	His	Tyr	Phe	Leu	Glu	Leu	Cys	Lys	Val	Lys
1				5					10					15	
Gln	Phe	Thr	Lys	Ala	Ala	Glu	Asn	Leu	Ala	Ile	Ser	Gln	Ala	Ala	Leu
			20					25					30		
Ser	Lys	Gln	Ile	Lys	Ile	Leu	Glu	Ala	Thr	Leu	Gly	Ala	Glu	Leu	Phe
		35					40					45			
Asn	Arg	Gln	Gly	Gln	Thr	Thr	Thr	Leu	Thr	Pro	Ala	Gly	Leu	Ile	Leu
	50					55					60				
Glu	Lys	Tyr	Cys	Trp	Arg	Ile	Thr	Asn	Glu	Leu	Val	Ser	Ile	Glu	Glu
65					70					75					80
Glu	Leu	Lys	Glu	Ile	Asn	His	Ser	Ser	Asn	His	Ile	Tyr	Val	Ala	Thr
				85					90					95	
Tyr	Leu	Cys	Asp	Leu	Glu	Tyr	Lys	Leu	Asn	Asp	Leu	Leu	Met	Thr	Thr
			100					105					110		
Leu	Thr	Asp	Arg	Ser	Ser	Asn	Leu	Gln	Val	His	Thr	Ile	Ile	Thr	Glu
		115					120					125			
Asn	Ile	Leu	Gln	Ser	Leu	Glu	Thr	Met	Asp	Ala	Asp	Phe	Gly	Ile	Ser
	130					135					140				
Phe	Ala	Asp	Leu	Pro	Leu	Pro	Glu	His	Ile	Gly	Lys	Ile	Asp	Leu	Phe
145					150					155					160
Thr	Ala	Asn	Tyr	Gln	Phe	Ile	Leu	Arg	Asn	Asp	His	Pro	Ala	Leu	Ala
				165					170					175	
Lys	Ala	Thr	Thr	Glu	Glu	Ile	Leu	Lys	Glu	Leu	Thr	Met	Tyr	Pro	Phe
			180					185					190		
Val	Arg	Leu	Asn	Thr	Glu	Phe	Ser	Glu	Gln	Asn	Lys	Leu	Thr	Asn	Trp
		195					200					205			
Leu	Asp	Thr	Thr	Phe	Ser	Asn	Phe	Ser	Pro	Glu	Lys	Val	Ile	Gln	Val
	210					215					220				
Asp	Thr	Leu	Ser	Leu	Ile	Thr	His	Leu	Val	Ser	His	Ser	Asp	Phe	Ala
225					230					235					240
Ile	Val	Pro	Glu	Tyr	Thr	Asn	Ile	Gln	Leu	Leu	Asp	Asn	Ser	Ile	His
				245					250					255	
Thr	Leu	Thr	Tyr	Gln	Glu	Leu	Pro	Lys	Arg	Asn	Met	Ala	Val	Tyr	Tyr
		260						265					270		
Leu	Lys	Glu	Arg	Tyr	Met	Ser	Arg	Gln	Leu	Gln	Gln	Leu	Leu	Ala	Glu
		275					280					285			
Cys	Gln	Lys	Gln	Phe	Gln										
	290														

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Figure 12A

XAA-His Dipeptidase

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acaaaaatta ccttcagaat atgatttagc taaagaatat aactgcagtc gcttgaccat 60
ccgtaaaagcg attgatgatt tgatccgcaa aaatatatttg gtaaaacgac atggtaaagg 120
tagttatgtg atgtcgcaag cgaaaattca aagtggctgc gctggcttac aagggttttac 180
tgaggcagcc aaagcttacg ggaaaaaaag ccagacagaa gtcatttcct ttgaagaagt 240
agtacatccc gctgagaaaaa ttcgggaggc gctccaagta ggcaaaaatg aggcaattta 300
tgaactgatt cgccgcccga tgtagacgg cgaaccaatg acagttgaaa aaatttattt 360
gccacaggca tacgtacaag gccatacgaa gcaagacttc gagggctctc tttctgctt 420
aatcgagaag aacgtcgaga ttgcttattc gcatcaagaa attgaagcaa tcttagttga 480
agcggaattt tcagaattat tgaatgttcc tgtgggccaa ccacttttac aagtccactc 540
tatcacctat gcgcttgatg caactcctat tttatatgat gtctctttat atcgagcaga 600
tcggtacacg tttaaaaaca cactgaccg ctatagcccg tctgaaaaaca accaagtggg 660
gctaggaggt tcttggaacg aatgaagatc aaagaagaaa tagccgctca aaaagattta 720
ttttatgaag acttaaaaca aattatcgcg attcgaagtg tgaaagggtc gcctaaaaaa 780
gaggcacctt ttggcgagg accgaaaaaga gccttggaag aaacgctgaa acttgcagag 840
cgttatgggt ttcaaaactgg gattgtcaat gcagcagttg gctatgcgca atggggaaca 900
gcggaagaat atctgggaat tattggtcat ttgatgtag taccagaagg ttctgggttg 960
tcagtgcgcg cctttcaatt aacgaaaaaa aatcaacgtt tgtatggtag aggaattcta 1020
gataataaag gtcctatctt ggcttgccgt tatggaatga aattactgaa agaacttggt 1080
taccaacca agaaaaaccat tcgcttaatg tttggcacgg atgaagaaag tgggagtgga 1140
gatatcccct tatatttaga gaaggaaaac gcaccggtt ttggatttac tccagattgt 1200
aaatatccag tagtttatgg ggagcgaggg attgttaatt atgagatcac aacgaccata 1260
ccagatgatt caagtgaaca aattggtcag attatagggt atcaagcaaa agaccacgta 1320
cctgatcaat taagtgtggt gattgcggga aaaacaacag caatcacggg aaaacgtgct 1380
ccttccaatg cgccagaact aggcaagaac gcgattactt tattggcaca gaaaattagc 1440
gaggaacagt tagtcaaagg aaatttatta cagtatttcg actggttaac cgctagtttt 1500
cacgaaaagc actatggcga aggagtagct ctggacttta aggatcagga tagtgggcaa 1560
ttgattttaa cgccctatgc gttggaaaaa agaggacagc aattgggtgt atcattggcc 1620
gtgcgttatc ctgtttctat tacagaaaac gaagtaacca cgcagctaac gaaggcata 1680
tttccagaaa gtgaagtgc cgtcatccgc cgctcccta gtacgtgtt tccaaaagat 1740
gagcgcaatg ttcaaaaatt aaccaagggt tatgaacaaa ttactggctt agatgggacg 1800
ccagtcacaa ctacaggtgc tacgtatgct cgctttatgc cgaatatcgt tgcttttggt 1860
ccatcatttc ctggtcaaaa aggcatgctg cataaccaag atgaatatat ggatgaaaaa 1920
gatttactgc ttaatctgga aatctatatg caagcgatga ttgcattaac agaagcataa 1980
aaccaataga agatacacgt atgagaagaa gacaatgtgt ttcgtagagg tcgcatacgt 2040
gtatcttcta tttttctgta taaaatttca ttttcagtat atacaaaaca gtatatacta 2100
gtttataatg gtggagaaat gtaagcgtaa acgaaagggc ggatggaaaa tgacttgggg 2160
tgcaattgcg acatggcgga tggcacatga tgggttacta aaagctacag aagaattaca 2220
acaaggaggt gctgcaggca cggccgtgga acaattaatt aaagaagtag aagactatcc 2280
ttttataaag tcagtgggct acggcgggtt acctaattgag gaagggattt tagaaatgga 2340

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Figure 12B

XAA-His Dipeptidase

Met	Lys	Ile	Lys	Glu	Glu	Ile	Ala	Ala	Gln	Lys	Asp	Leu	Phe	Tyr	Glu	1	5	10	15
Asp	Leu	Asn	Lys	Ile	Ile	Ala	Ile	Arg	Ser	Val	Lys	Gly	Ser	Pro	Lys	20	25	30	
Lys	Glu	Ala	Pro	Phe	Gly	Glu	Gly	Pro	Lys	Arg	Ala	Leu	Glu	Glu	Thr	35	40	45	
Leu	Lys	Leu	Ala	Glu	Arg	Tyr	Gly	Phe	Gln	Thr	Gly	Ile	Val	Asn	Asp	50	55	60	
Ala	Val	Gly	Tyr	Ala	Gln	Trp	Gly	Thr	Ala	Glu	Glu	Tyr	Leu	Gly	Ile	65	70	75	80
Ile	Gly	His	Leu	Asp	Val	Val	Pro	Glu	Gly	Ser	Gly	Trp	Ser	Val	Pro	85	90	95	
Pro	Phe	Gln	Leu	Thr	Lys	Lys	Asn	Gln	Arg	Leu	Tyr	Gly	Arg	Gly	Ile	100	105	110	
Leu	Asp	Asn	Lys	Gly	Pro	Ile	Leu	Ala	Cys	Leu	Tyr	Gly	Met	Lys	Leu	115	120	125	
Leu	Lys	Glu	Leu	Gly	Tyr	Gln	Pro	Lys	Lys	Thr	Ile	Arg	Leu	Met	Phe	130	135	140	
Gly	Thr	Asp	Glu	Glu	Ser	Gly	Ser	Gly	Asp	Ile	Pro	Leu	Tyr	Leu	Glu	145	150	155	160
Lys	Glu	Asn	Ala	Pro	Val	Phe	Gly	Phe	Thr	Pro	Asp	Cys	Lys	Tyr	Pro	165	170	175	
Val	Val	Tyr	Gly	Glu	Arg	Gly	Ile	Val	Asn	Tyr	Glu	Ile	Thr	Thr	Thr	180	185	190	
Ile	Pro	Asp	Asp	Ser	Ser	Glu	Gln	Ile	Gly	Gln	Ile	Ile	Gly	Asp	Gln	195	200	205	
Ala	Lys	Asp	His	Val	Pro	Asp	Gln	Leu	Ser	Val	Val	Ile	Ala	Gly	Lys	210	215	220	
Thr	Thr	Ala	Ile	Thr	Gly	Lys	Arg	Ala	Pro	Ser	Asn	Ala	Pro	Glu	Leu	225	230	235	240
Gly	Lys	Asn	Ala	Ile	Thr	Leu	Leu	Ala	Gln	Lys	Ile	Ser	Glu	Glu	Gln	245	250	255	
Leu	Val	Lys	Gly	Asn	Leu	Leu	Gln	Tyr	Phe	Asp	Trp	Leu	Thr	Ala	Ser	260	265	270	
Phe	His	Glu	Lys	His	Tyr	Gly	Glu	Gly	Val	Ala	Leu	Asp	Phe	Lys	Asp	275	280	285	
Gln	Asp	Ser	Gly	Gln	Leu	Ile	Leu	Thr	Pro	Tyr	Ala	Leu	Glu	Lys	Arg	290	295	300	
Gly	Gln	Gln	Leu	Val	Leu	Ser	Leu	Ala	Val	Arg	Tyr	Pro	Val	Ser	Ile	305	310	315	320
Thr	Glu	Asn	Glu	Val	Thr	Thr	Gln	Leu	Thr	Lys	Ala	Leu	Phe	Pro	Glu	325	330	335	
Ser	Glu	Val	Thr	Val	Ile	Arg	Arg	Leu	Pro	Ser	Thr	Leu	Phe	Pro	Lys	340	345	350	
Asp	Glu	Arg	Asn	Val	Gln	Lys	Leu	Thr	Lys	Val	Tyr	Glu	Gln	Ile	Thr	355	360	365	
Gly	Leu	Asp	Gly	Thr	Pro	Val	Thr	Thr	Thr	Gly	Ala	Thr	Tyr	Ala	Arg	370	375	380	
Phe	Met	Pro	Asn	Ile	Val	Ala	Phe	Gly	Pro	Ser	Phe	Pro	Gly	Gln	Lys	385	390	395	400
Gly	Ile	Ala	His	Asn	Gln	Asp	Glu	Tyr	Met	Asp	Glu	Lys	Asp	Leu	Leu	405	410	415	
Leu	Asn	Leu	Glu	Ile	Tyr	Met	Gln	Ala	Met	Ile	Ala	Leu	Thr	Glu	Ala	420	425	430	

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Figure 13A

SacU

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cattttttat taaattacat atttgaata ggaatttcct gtgaaatgag gtatcctaag 60
aaaggtgata aaacacagag gtaaaggagt gacacgatga gtcgtgtaga tcgttataaa 120
catattcatg aaaaatcgag accagcagag cataaaaaga cctttaatcc ccgaaaatca 180
atgggtgaac atagagaaga agaaccagaa gaactagctg aaagccttca agagccagtt 240
tacgaagaca gctatactga ggacagtcgc agaagtgaga ggcgacatca aacagattca 300
gggtggggca acggttctga ccaaccaccc cgcggaaaaa aagacaagaa accaaaaaag 360
aaacgtaaaa aatcaaaaac aaaacgcttt ttcaaatggc tagtgatcct attgattctg 420
ttatttgcct atagtacagt catgttttta aaaggaaaat ctgcagcaga acatgatgac 480
tcgttgcctc aagaaaaagt agaaacattt aatgggtgtca aaagtagcaa cggggctaag 540
aatattttta ttcttggcag cgatacacgt ggggaaagatg ctggacgagc cgacacaata 600
atgggttctcc aactaaatgg accatcaaaa aaaccgaaat taatttcatt tatgcgtgat 660
acattcgtgg acattcctgg tgtcgggccc aataaaatta atgccgcata cgcttatggc 720
gggtgctgaat tgggtcgtga aacgttaaaa caaaacttta atttagatac gaaatattat 780
gctaaggtag atttccaatc atttgaaaaa attgttgact ctatgtttcc aaaaggtgtc 840
aaaatcgatg cagaaaaatc actgaattta gatgggtgtg atattgaaaa agggcaacag 900
gtcatggatg gacatgtctt acttcaatac gctcgtttta ggatggatga agaaggcgac 960
tttggtcggg ttctgcgcca acaacaagtt atgtcagctg taatgagcca aatgaaaaac 1020
ccaatgactt tattaagaac ccagaatca cttgggaaat tagtcggcta tatgtcgaca 1080
gatgtgcctg ttagtttcat gttaacgaat ggaccatcat tgttgattaa aggaaaagca 1140
ggggttgagt cattatcggg tccggtacca gattcttgga attttggtga atcctcttat 1200
gcaggcagta ttttagaagt agatgaacaa aaaaatgctg acgccatcga aaaattcctg 1260
aacgaataag gaaagcattt taaaatatcc ttttttatgc tatattagaa acaacgtgga 1320
aaattagtga aacgaggtta caaaatgaaa attgctattg tgacagatag tacagcttat 1380
ttacccgagc gcattaaaga tcatccgaat ctttttgtaa ttcccatccc agtcatttta 1440
gatggaaaaa tatacaacga aggcattgac attgaagcag atgaatatta tgcattgcta 1500
aataatagta aagaatttcc gacgacttca caacctgctt taggagaagt gttagagctt 1560
tacaaatcaa tcgctgaaca agggtagcag accatcatca gcattcatct ttcttcagga 1620
atctctgggt ttgttcatac attgcacgga cttaccgatg aaatcccagg cgttgctttg 1680
tatccatatt actcaaaaat tacaagtatg ccaatgggac acatggtaga agctgcttta 1740
gatttaacag aagaaaaagc cagcttagaa gaaatttttg ccaaattaga tttaattcgt 1800
gacaatacgt atgcatatct aattgtagaa gatctgaaca acttagttcg tggcggtcgc 1860
ttaacgaatg ggcgagcctt gatcgctgga ctattgaaga ttaaacctat cttgactttt 1920
gaagatggaa agattgtatt atttgaaaaa atccgttcaa caaagaaagc ttttgctcgt 1980
gcagaaaaga ttattggtga acgaaacgca gggattgaag caccagttaa actgtatgtg 2040
attcatgcca ataaccgcat cgttgctgaa aaagaacaag caaaattaca aaagctatac 2100
ccaaatgcag aaattgaaat tggtcatttt ggtccagtta tcgggaccca cctaggggaa 2160
aaagcaattg gtttagcgat ttcagctcaa taataaaaaga tgagacaaaa gtaaactact 2220
tctgtctcat cttttattct attattttat cgttcgctgg tgttactcag ccgaacactt 2280
tttgtttata agaaaatgta aaattactcc tttttattag aaaatatctt gcaaattaag 2340
caattcctta caaagtaatg ta 2362

```

Figure 13B

SacU
Met Lys Ile Ala Ile Val Thr Asp Ser Thr Ala Tyr Leu Pro Glu Arg
1 5 10 15
Ile Lys Asp His Pro Asn Leu Phe Val Ile Pro Ile Pro Val Ile Leu
20 25 30
Asp Gly Lys Ile Tyr Asn Glu Gly Ile Asp Ile Glu Ala Asp Glu Tyr
35 40 45
Tyr Ala Leu Leu Asn Asn Ser Lys Glu Phe Pro Thr Thr Ser Gln Pro
50 55 60
Ala Leu Gly Glu Val Leu Glu Leu Tyr Lys Ser Ile Ala Glu Gln Gly
65 70 75 80
Tyr Asp Thr Ile Ile Ser Ile His Leu Ser Ser Gly Ile Ser Gly Phe
85 90 95
Val His Thr Leu His Gly Leu Thr Asp Glu Ile Pro Gly Val Ala Leu
100 105 110
Tyr Pro Tyr Asp Ser Lys Ile Thr Ser Met Pro Met Gly His Met Val
115 120 125
Glu Ala Ala Leu Asp Leu Thr Glu Glu Lys Ala Ser Leu Glu Glu Ile
130 135 140
Phe Ala Lys Leu Asp Leu Ile Arg Asp Asn Thr Tyr Ala Tyr Leu Ile
145 150 155 160
Val Glu Asp Leu Asn Asn Leu Val Arg Gly Gly Arg Leu Thr Asn Gly
165 170 175
Ala Ala Leu Ile Ala Gly Leu Leu Lys Ile Lys Pro Ile Leu Thr Phe
180 185 190
Glu Asp Gly Lys Ile Val Leu Phe Glu Lys Ile Arg Ser Thr Lys Lys
195 200 205
Ala Phe Ala Arg Ala Glu Lys Ile Ile Gly Glu Arg Asn Ala Gly Ile
210 215 220
Glu Ala Pro Val Lys Leu Tyr Val Ile His Ala Asn Asn Arg Ile Val
225 230 235 240
Ala Glu Lys Glu Gln Ala Lys Leu Gln Lys Leu Tyr Pro Asn Ala Glu
245 250 255
Ile Glu Ile Gly His Phe Gly Pro Val Ile Gly Thr His Leu Gly Glu
260 265 270
Lys Ala Ile Gly Leu Ala Ile Ser Ala Gln
275 280

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Figure 14A

Pail

gagattatct	aaagaaaagt	aagcacaatt	cgagggtttca	atgttttttt	caaagggatg	60
attttctaga	atgtcacaaag	aaaagatcat	tttatagtae	tgaaatagtt	gaggaatgtc	120
ttttcgttta	tctgtatcat	aaacagcaag	caattctttt	gctgtaacaa	ctaagccagt	180
ttcttccaat	acttcttttt	caatatatttc	tttaggagag	cagccaattt	cggcatagcc	240
accaggtaat	gaccattctt	tggtccgtaa	atcttcaact	aataaaaaac	gattctcttt	300
ttttatcaaa	ccgcgaacat	ctactttcgg	tggtggataa	ccttcttctt	tagttaagat	360
tttttctaag	tcgggcaaga	cagtcgcttc	gtgtccggtt	gcgctaataa	gttgtaacgt	420
aagttctcgt	agttcttggt	aacggttctg	atcaaaaagca	tctttcccg	aaaaaagacc	480
agcatctgcc	aatgctagca	accgcttata	agtgttcaga	taatccatat	acgcacgctc	540
ctcatagact	taatacgttt	agtttaacag	aaaaaaataa	agaaagggca	gatttagcga	600
gaaaaggcgt	cgttttaagg	aaataataaa	gaataaatga	ctaacttaca	tttttaact	660
acctatgcta	ttatttaata	aaaaagattg	ggtatacaat	aattttgtta	tgtaaacaaa	720
aaggaggttg	taaattgaaa	gaattttacaa	ttataagggg	aaaaaatgca	gataaaaaaga	780
ctcaggcagc	acaagaagta	ttgtttaatc	ttccagaatg	gtttggcctt	gaaaaagaga	840
cccgaagta	tatcgatata	gctagcactt	tacctatgtg	ggtggcaaa	gatgtagaga	900
ataaaatact	cggttttata	aaccaagtaa	agatacagta	gaaatccatt		960
gtatggcagt	taaaaagcgg	tatcatcgca	aagggtatcg	caagttattg	atagaaagcg	1020
tggaacgta	ttctaaaaat	aactattttt	ttattcaagt	caaaacagtt	gacgaaggaa	1080
attattccgt	gtacgatcat	actattcgtt	tttacgaatc	attgggtttt	aagcgccttg	1140
aggtttttcc	gacattatgg	gacgcttgga	atccttggtt	aatttttaatt	aaacagttga	1200
tttaatctac	aaaggagttt	tagtatgtca	gtatttatta	gagagtgtac	cgtcgcagac	1260
gtaccagaat	tagaggccat	ttgccaagag	acttttgcag	atacttatgg	agatggcgaa	1320
aacgaaaagg	atttacaggc	acattatgag	aggaaattta	gtccagcagt	tttagaaaagc	1380
gaaatcttac	ataaagattc	gcaatatttc	tttgcttttt	ataataatga	acttgcaggt	1440
tatgtgaaat	taaatcacgg	tgatgctcag	attacctatc	aacatccaca	agcgttacaa	1500
gttgagcgca	tttatattcg	taaatctttt	aagcgtttag	gcttaggcaa	acatttgatt	1560
acgaaagcaa	ttgaattagc	ggaagaagca	gaaaaagaga	cggtttggtt	aggtgtttgg	1620
gaacataatc	atccagcgca	aaaattttat	caatcattgg	gcttcgtcaa	aacagatgaa	1680
catgattttt	atatgggaaa	tgaacgccat	accgattata	caatgacgaa	acagttaaaa	1740
gagtcaacg	aaagcaaaaa	caaggaaacg	gacgcaatga	agccgacgat	tccttgtttt	1800
tttatcttaa	aattgtgaag	gagattttcc	ataatatattt	ttgaataatt	tactgaaatg	1860
ataggcatct	tcgtaaccaa	ccgtttttgc	cacttctttg	acacttaggg	aatcattttt	1920
cagcaattct	ttcgcatgg	ttaagcggat	ttgaattaaa	taattgattg	gccaacgcc	1980
tgtggccgct	ttaaagggtt	tcgacaaaata	agtcgggggtc	acatatagca	tttcagctaa	2040
ctgttccaaa	gtaatttctt	cgtcatgggtg	cgtttccaga	taataaatcg	tatgattgac	2100
taaatttcgt	tttctttttt	ccgttttcga	tagccgagtt	tcaattttat	tttcttgatc	2160
aactgctaag	cttcttaaaa	tatagaccaa	tagttcaata	act		2203

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Figure 14B

Pail
 Met Ser Val Phe Ile Arg Glu Cys Thr Val Ala Asp Val Pro Glu Leu
 1 5 10 15
 Glu Ala Ile Cys Gln Glu Thr Phe Ala Asp Thr Tyr Gly Asp Gly Glu
 20 25 30
 Asn Glu Lys Asp Leu Gln Ala His Tyr Glu Arg Lys Phe Ser Pro Ala
 35 40 45
 Val Leu Glu Ser Glu Ile Leu His Lys Asp Ser Gln Tyr Phe Phe Ala
 50 55 60
 Phe Tyr Asn Asn Glu Leu Ala Gly Tyr Val Lys Leu Asn His Gly Asp
 65 70 75 80
 Ala Gln Ile Thr Tyr Gln His Pro Gln Ala Leu Gln Val Glu Arg Ile
 85 90 95
 Tyr Ile Arg Lys Ser Phe Lys Arg Leu Gly Leu Gly Lys His Leu Ile
 100 105 110
 Thr Lys Ala Ile Glu Leu Ala Glu Glu Ala Glu Lys Glu Thr Val Trp
 115 120 125
 Leu Gly Val Trp Glu His Asn His Pro Ala Gln Lys Phe Tyr Gln Ser
 130 135 140
 Leu Gly Phe Val Lys Thr Asp Glu His Asp Phe Tyr Met Gly Asn Glu
 145 150 155 160
 Arg His Thr Asp Tyr Thr Met Thr Lys Gln Leu Lys Glu Ser Thr
 165 170 175

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Figure 15A

Enterococcal amino acid biosynthetic gene cluster

```

ccatgtagat ttaagaaaat ctatagtggc ttttatattg cttttttgta gggatttcac 60
tgtagatttt tcttaaaatt tactgtgaat atcctttttg tttggccaaa aattaggatt 120
tcagaaactt actaaaaaaa tttcgtaaag gagcacacag g atg aaa gaa ata act 176
                                     Met Lys Glu Ile Thr
                                     1       5

gga gcc act cgt tta gct ggg cta ttc gcg aaa ccc agc caa cac agt 224
Gly Ala Thr Arg Leu Ala Gly Leu Phe Ala Lys Pro Ser Gln His Ser
                        10                15                20

att tca ccg ttg att cat aat aca gca ttt caa aat tta gga gtt gat 272
Ile Ser Pro Leu Ile His Asn Thr Ala Phe Gln Asn Leu Gly Val Asp
                        25                30                35

gct cgg tat ctg gcg ttt gac gtt gga caa gag aca ttg cca caa gca 320
Ala Arg Tyr Leu Ala Phe Asp Val Gly Gln Glu Thr Leu Pro Gln Ala
                        40                45                50

att gaa gcg att cga acg ttt cac atg tta ggg gcc aac tta tca atg 368
Ile Glu Ala Ile Arg Thr Phe His Met Leu Gly Ala Asn Leu Ser Met
                        55                60                65

ccc aat aaa gtg gcg gct gta agt tat atg gat gaa cta agt cct acc 416
Pro Asn Lys Val Ala Ala Val Ser Tyr Met Asp Glu Leu Ser Pro Thr
                        70                75                80                85

gct caa ctg gtt ggc gca att aat acg att gtc aac aaa gat gga aaa 464
Ala Gln Leu Val Gly Ala Ile Asn Thr Ile Val Asn Lys Asp Gly Lys
                        90                95                100

ctt tac gga gac agc acg gat ggt act ggt ttt atg tgg agt ttg aaa 512
Leu Tyr Gly Asp Ser Thr Asp Gly Thr Gly Phe Met Trp Ser Leu Lys
                        105                110                115

gag aaa aag gtt gac gtt ttt cag aat aaa atg acc atc tta gga aca 560
Glu Lys Lys Val Asp Val Phe Gln Asn Lys Met Thr Ile Leu Gly Thr
                        120                125                130

ggt ggt gca gcc tta tca atc att gcc caa gct gct tta gat ggc gtg 608
Gly Gly Ala Ala Leu Ser Ile Ile Ala Gln Ala Ala Leu Asp Gly Val
                        135                140                145

aaa gaa atc gcc gtt tac aac agg aaa agc gcg ggc ttt aac gac agt 656
Lys Glu Ile Ala Val Tyr Asn Arg Lys Ser Ala Gly Phe Asn Asp Ser
                        150                155                160                165

caa aaa aaa ctg gca aat ttc act gaa cga acc aac tgt gta att cat 704
Gln Lys Lys Leu Ala Asn Phe Thr Glu Arg Thr Asn Cys Val Ile His
                        170                175                180

tta aac gat tta gcg gat act gaa aaa cta gca aaa gat gtt gct gaa 752
Leu Asn Asp Leu Ala Asp Thr Glu Lys Leu Ala Lys Asp Val Ala Glu
                        185                190                195

agc gtc ttg tta gtt aat gca acg agt gtg ggt atg cat cca cat gcg 800
Ser Val Leu Leu Val Asn Ala Thr Ser Val Gly Met His Pro His Ala
                        200                205                210

cat agt agt cct ata gaa aat tat gca atg att caa ccg aag tta ttt 848

```

His	Ser	Ser	Pro	Ile	Glu	Asn	Tyr	Ala	Met	Ile	Gln	Pro	Lys	Leu	Phe	
215						220					225					
gtg	tat	gat	gct	att	tat	aat	ccc	aga	gaa	aca	cag	tta	tta	aaa	gaa	896
Val	Tyr	Asp	Ala	Ile	Tyr	Asn	Pro	Arg	Glu	Thr	Gln	Leu	Leu	Lys	Glu	
230					235					240					245	
gcc	cgt	tta	cgt	ggt	gca	gaa	aca	agc	aac	ggc	ttg	gac	atg	cta	ctt	944
Ala	Arg	Leu	Arg	Gly	Ala	Glu	Thr	Ser	Asn	Gly	Leu	Asp	Met	Leu	Leu	
				250					255					260		
tat	caa	ggc	gct	gct	gct	ttt	gaa	caa	tgg	aca	gga	caa	aaa	atg	cct	992
Tyr	Gln	Gly	Ala	Ala	Ala	Phe	Glu	Gln	Trp	Thr	Gly	Gln	Lys	Met	Pro	
			265					270						275		
gta	tca	gtc	gta	aaa	cgt	aaa	att	gaa	aat	aga	taa	aaagagcgcc				1038
Val	Ser	Val	Val	Lys	Arg	Lys	Ile	Glu	Asn	Arg	*					
			280				285									
gtttaaaggc	atgaggagag	aatata	atg	atc	gta	att	atg	aaa	gaa	aat	gca					1091
			Met	Ile	Val	Ile	Met	Lys	Glu	Asn	Ala					
							290				295					
acc	gaa	aag	caa	atg	aaa	caa	gtc	att	gat	tta	gta	aca	ggg	gca	ggc	1139
Thr	Glu	Lys	Gln	Met	Lys	Gln	Val	Ile	Asp	Leu	Val	Thr	Gly	Ala	Gly	
			300				305					310				
tta	act	act	caa	aca	agt	caa	gat	aat	gga	aaa	aca	gtg	ata	ggc	ttg	1187
Leu	Thr	Thr	Gln	Thr	Ser	Gln	Asp	Asn	Gly	Lys	Thr	Val	Ile	Gly	Leu	
			315			320					325					
att	ggg	gat	aca	gaa	aaa	tta	gtt	gaa	gca	gag	tta	aca	gca	tta	gaa	1235
Ile	Gly	Asp	Thr	Glu	Lys	Leu	Val	Glu	Ala	Glu	Leu	Thr	Ala	Leu	Glu	
330					335					340					345	
ggc	gtg	gag	aaa	agt	gtc	cgc	att	tcg	ttg	tct	tac	aaa	cta	acg	agt	1283
Gly	Val	Glu	Lys	Ser	Val	Arg	Ile	Ser	Leu	Ser	Tyr	Lys	Leu	Thr	Ser	
				350					355					360		
cgt	tta	ttt	cat	cca	gag	aat	aca	gtg	gtt	gat	gtg	aac	ggg	gtt	aaa	1331
Arg	Leu	Phe	His	Pro	Glu	Asn	Thr	Val	Val	Asp	Val	Asn	Gly	Val	Lys	
			365				370						375			
atc	ggg	gac	ggc	agt	atg	acc	atg	atg	gcg	ggc	cct	tgt	tca	atc	gaa	1379
Ile	Gly	Asp	Gly	Ser	Met	Thr	Met	Met	Ala	Gly	Pro	Cys	Ser	Ile	Glu	
			380				385					390				
agc	tta	gat	cag	att	cgc	gaa	tgt	gcg	cga	att	gct	aaa	gct	gga	ggg	1427
Ser	Leu	Asp	Gln	Ile	Arg	Glu	Cys	Ala	Arg	Ile	Ala	Lys	Ala	Gly	Gly	
			395			400					405					
gca	aca	att	tta	cga	ggg	ggg	gca	ttc	aaa	cct	aga	acg	tcg	cca	tac	1475
Ala	Thr	Ile	Leu	Arg	Gly	Gly	Ala	Phe	Lys	Pro	Arg	Thr	Ser	Pro	Tyr	
410					415					420					425	
gct	ttc	caa	gga	cta	gaa	gaa	gaa	gga	cta	aaa	tac	att	cgc	caa	gcg	1523
Ala	Phe	Gln	Gly	Leu	Glu	Glu	Glu	Gly	Leu	Lys	Tyr	Ile	Arg	Gln	Ala	
				430				435						440		
gct	gat	gaa	tta	gat	atg	caa	gtc	att	aca	gaa	gtg	atg	gat	gaa	gcg	1571
Ala	Asp	Glu	Leu	Asp	Met	Gln	Val	Ile	Thr	Glu	Val	Met	Asp	Glu	Ala	

Fig. 15A
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445	450	455	
aat tta gaa ctt gtc gca aaa tac agt gac att tta caa atc ggt gcg Asn Leu Glu Leu Val Ala Lys Tyr Ser Asp Ile Leu Gln Ile Gly Ala 460 465 470			1619
cgc aac atg caa aat ttc aag tta tta caa gcg gtt ggt aaa act gga Arg Asn Met Gln Asn Phe Lys Leu Leu Gln Ala Val Gly Lys Thr Gly 475 480 485			1667
aaa cct att ggc tta aaa cgc ggg att gct ggt acg att gat gaa tgg Lys Pro Ile Gly Leu Lys Arg Gly Ile Ala Gly Thr Ile Asp Glu Trp 490 495 500 505			1715
cta aac gca gct gaa tac att gct gcg caa gga aat ttc aat gtg atc Leu Asn Ala Ala Glu Tyr Ile Ala Ala Gln Gly Asn Phe Asn Val Ile 510 515 520			1763
ttc att gaa cgt ggg att cgt acg tac gaa acc gct acg cgc aat aca Phe Ile Glu Arg Gly Ile Arg Thr Tyr Glu Thr Ala Thr Arg Asn Thr 525 530 535			1811
ctt gat tta agt gcg gtg cct tta att aaa aaa tta agt cat ttt cca Leu Asp Leu Ser Ala Val Pro Leu Ile Lys Lys Leu Ser His Phe Pro 540 545 550			1859
att att gtt gat ccg agt cat ggt gtt ggt atc tgg gat tta gta ccg Ile Ile Val Asp Pro Ser His Gly Val Gly Ile Trp Asp Leu Val Pro 555 560 565			1907
cca atg gcc cga gca ggt gtt gct tca ggt gcg gac ggc ttg att gta Pro Met Ala Arg Ala Gly Val Ala Ser Gly Ala Asp Gly Leu Ile Val 570 575 580 585			1955
gaa att cat cca gat cca gcg aat gcg tgg tca gat ggc cca caa tcc Glu Ile His Pro Asp Pro Ala Asn Ala Trp Ser Asp Gly Pro Gln Ser 590 595 600			2003
ttg aat gaa aaa act tac cta cgt atg atg aaa gaa gtt cat atc atc Leu Asn Glu Lys Thr Tyr Leu Arg Met Met Lys Glu Val His Ile Ile 605 610 615			2051
gaa aaa gca atg aaa gaa att aat gct tta gaa gat tag taaagacaga Glu Lys Ala Met Lys Glu Ile Asn Ala Leu Glu Asp *			2100
ggagtagagg ac atg aaa tta acc gta acg tta cct aca cat tca tat gat Met Lys Leu Thr Val Thr Leu Pro Thr His Ser Tyr Asp 630 635 640			2151
tta acc atc gaa aca ggt gcc tta gat aaa att ggc acc tgg gta cgt Leu Thr Ile Glu Thr Gly Ala Leu Asp Lys Ile Gly Thr Trp Val Arg 645 650 655			2199
agc ctg tgg cag cca caa cgg gta gcg att att acc gat gaa acg gtg Ser Leu Trp Gln Pro Gln Arg Val Ala Ile Ile Thr Asp Glu Thr Val 660 665 670			2247
aat aaa tta tat ggc gca gct gtt gag aaa gaa ttg caa gct gct ggt Asn Lys Leu Tyr Gly Ala Ala Val Glu Lys Glu Leu Gln Ala Ala Gly 675 680 685 690			2295

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Fig. 15A
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ttt gaa aca tca ttg att gct gta gcg gca ggt gaa caa agt aag agc	2343
Phe Glu Thr Ser Leu Ile Ala Val Ala Ala Gly Glu Gln Ser Lys Ser	
695 700 705	
ctc gaa ata gct caa ctg ctt tat gat ttt tta gcg gaa cag caa ttg	2391
Leu Glu Ile Ala Gln Leu Leu Tyr Asp Phe Leu Ala Glu Gln Gln Leu	
710 715 720	
act cga agt gat ggt cta att gct tta ggt gga ggc gtt gtg gga gat	2439
Thr Arg Ser Asp Gly Leu Ile Ala Leu Gly Gly Gly Val Val Gly Asp	
725 730 735	
cta gct gga ttt gtc gct tca acc tat atg cgc ggt att cac ttt ttg	2487
Leu Ala Gly Phe Val Ala Ser Thr Tyr Met Arg Gly Ile His Phe Leu	
740 745 750	
caa gta cca aca acc tta ctg gca caa gta gat agt agc att gga ggt	2535
Gln Val Pro Thr Thr Leu Leu Ala Gln Val Asp Ser Ser Ile Gly Gly	
755 760 765 770	
aaa aca gcg gtt aat act aaa aaa gcc aaa aat ctt gtc ggt act ttt	2583
Lys Thr Ala Val Asn Thr Lys Lys Ala Lys Asn Leu Val Gly Thr Phe	
775 780 785	
gcc caa cca gat ggg gtt tta att gat cct aat aca ctt aaa aca tta	2631
Ala Gln Pro Asp Gly Val Leu Ile Asp Pro Asn Thr Leu Lys Thr Leu	
790 795 800	
gaa cct aga cgt gtg cgt gaa gga att gca gaa att gta aaa tca gca	2679
Glu Pro Arg Arg Val Arg Glu Gly Ile Ala Glu Ile Val Lys Ser Ala	
805 810 815	
gct atc gct gat gtt gaa ttg tgg cac cgt tta tcc tct ttg gaa aat	2727
Ala Ile Ala Asp Val Glu Leu Trp His Arg Leu Ser Ser Leu Glu Asn	
820 825 830	
gaa caa gat tta gtg gca cat gca gaa gaa att atc acg gcc tgt tgc	2775
Glu Gln Asp Leu Val Ala His Ala Glu Glu Ile Ile Thr Ala Cys Cys	
835 840 845 850	
aag att aaa cgt gat gtc gtc gaa gaa gat gaa tta gat ttg ggc tta	2823
Lys Ile Lys Arg Asp Val Val Glu Glu Asp Glu Leu Asp Leu Gly Leu	
855 860 865	
cgt ttg att ctg aat ttt ggg cat acg atc ggc cac gca tta gaa aat	2871
Arg Leu Ile Leu Asn Phe Gly His Thr Ile Gly His Ala Leu Glu Asn	
870 875 880	
aca gct ggt tac ggg gtg att gct cac ggt gaa ggc gtt tct tta gga	2919
Thr Ala Gly Tyr Gly Val Ile Ala His Gly Glu Gly Val Ser Leu Gly	
885 890 895	
atg att caa ata act caa gtc gca gaa caa caa ggc ctt tcc cca ctt	2967
Met Ile Gln Ile Thr Gln Val Ala Glu Gln Gln Gly Leu Ser Pro Leu	
900 905 910	
ggg act acc caa gag ttg gtc acc atg cta gaa aag ttc cat tta cca	3015
Gly Thr Thr Gln Glu Leu Val Thr Met Leu Glu Lys Phe His Leu Pro	
915 920 925 930	

Title: Enterococcal Virulence Factors

Applicant(s): Ausubel et al.

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Fig. 15A
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gta acc aca gat cgt tgg tca gaa gaa cgt ctc tat caa gca att aca	3063
Val Thr Thr Asp Arg Trp Ser Glu Glu Arg Leu Tyr Gln Ala Ile Thr	
935 940 945	
cat gat aaa aaa aca cgt ggg gga cag att aaa atc att gtc tta gaa	3111
His Asp Lys Lys Thr Arg Gly Gly Gln Ile Lys Ile Ile Val Leu Glu	
950 955 960	
aaa att ggt caa gcg aaa att gtc tct tta cca acg gaa gaa att cga	3159
Lys Ile Gly Gln Ala Lys Ile Val Ser Leu Pro Thr Glu Glu Ile Arg	
965 970 975	
gca ttt tta aac aga gaa gga gga att taa g atg cgc ttt att aca gca	3208
Ala Phe Leu Asn Arg Glu Gly Gly Ile * Met Arg Phe Ile Thr Ala	
980 985 990	
ggc gaa tca cat gga cct gaa tta act gct att att gaa ggc tta cca	3256
Gly Glu Ser His Gly Pro Glu Leu Thr Ala Ile Ile Glu Gly Leu Pro	
995 1000 1005	
gcc gcc ttg cct tta agt agc gaa gag att aac cga gaa tta gca aga	3304
Ala Gly Leu Pro Leu Ser Ser Glu Glu Ile Asn Arg Glu Leu Ala Arg	
1010 1015 1020 1025	
cgt caa ggc ggt tac ggt cgt ggg gga cgg atg aaa att gaa aaa gac	3352
Arg Gln Gly Gly Tyr Gly Arg Gly Gly Arg Met Lys Ile Glu Lys Asp	
1030 1035 1040	
caa gta cgt att act tcg ggt att cgg cat ggt aaa aca ctt ggc tca	3400
Gln Val Arg Ile Thr Ser Gly Ile Arg His Gly Lys Thr Leu Gly Ser	
1045 1050 1055	
cca gta acg ttg att gtc gaa aac aaa gac tgg aaa aat tgg acc tcc	3448
Pro Val Thr Leu Ile Val Glu Asn Lys Asp Trp Lys Asn Trp Thr Ser	
1060 1065 1070	
gtg atg tca gta gag cca gtt cct gaa aaa caa aag aaa atc cgc cgc	3496
Val Met Ser Val Glu Pro Val Pro Glu Lys Gln Lys Lys Ile Arg Arg	
1075 1080 1085	
gtc agc aaa cca cgt cca gga cat gct gat tta gtc ggt ggc atg aaa	3544
Val Ser Lys Pro Arg Pro Gly His Ala Asp Leu Val Gly Gly Met Lys	
1090 1095 1100 1105	
tat caa cat gat gat tta cgg aat gtt tta gaa cgg tct tcg gca cga	3592
Tyr Gln His Asp Asp Leu Arg Asn Val Leu Glu Arg Ser Ser Ala Arg	
1110 1115 1120	
gaa aca acg atg cgt gtg gcg att ggt gcg gtt gct aaa aaa ctc tta	3640
Glu Thr Thr Met Arg Val Ala Ile Gly Ala Val Ala Lys Lys Leu Leu	
1125 1130 1135	
gct gaa ctg gat atc caa gtc gct ggg cat gtc gcg gta tta ggt ggg	3688
Ala Glu Leu Asp Ile Gln Val Ala Gly His Val Ala Val Leu Gly Gly	
1140 1145 1150	
att gaa gct acg atc cct gaa aat tta acg att cgt gaa att caa gaa	3736
Ile Glu Ala Thr Ile Pro Gln Asn Leu Thr Ile Arg Glu Ile Gln Glu	
1155 1160 1165	
cga tct gaa caa tct gcc gtt cgc gta tta gat cct tcc gta gaa gaa	3784

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Fig. 15A
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Arg Ser Glu Gln Ser Ala Val Arg Val Leu Asp Pro Ser Val Glu Glu	
1170 1175 1180 1185	
aaa atg aaa gaa cta att gac caa acc aag aaa aat ggc gat aca att	3832
Lys Met Lys Glu Leu Ile Asp Gln Thr Lys Lys Asn Gly Asp Thr Ile	
1190 1195 1200	
ggt ggg gta gta gaa gta ctt gtg ggt ggc gtt cca gct ggc tta ggt	3880
Gly Gly Val Val Glu Val Leu Val Gly Gly Val Pro Ala Gly Leu Gly	
1205 1210 1215	
agc tat gtc caa tgg gat cgt aaa cta gat gcc aaa att gcg caa gca	3928
Ser Tyr Val Gln Trp Asp Arg Lys Leu Asp Ala Lys Ile Ala Gln Ala	
1220 1225 1230	
gtt gta agc atc aac gct ttt aca ggt gct gag ttt ggc att gga ttt	3976
Val Val Ser Ile Asn Ala Phe Thr Gly Ala Glu Phe Gly Ile Gly Phe	
1235 1240 1245	
gaa atg gca caa cgc cct ggt agt caa ctg atg gac gag att gtt tgg	4024
Glu Met Ala Gln Arg Pro Gly Ser Gln Leu Met Asp Glu Ile Val Trp	
1250 1255 1260 1265	
gac gaa agt act ggt tat acc aga act tcc aac aat tta ggc ggt ttt	4072
Asp Glu Ser Thr Gly Tyr Thr Arg Thr Ser Asn Asn Leu Gly Gly Phe	
1270 1275 1280	
gaa gga gga atg acc aac gga atg cca atc atc gtt cgt ggt gtc atg	4120
Glu Gly Gly Met Thr Asn Gly Met Pro Ile Ile Val Arg Gly Val Met	
1285 1290 1295	
aaa cct att cca acc ctt tat aaa cca tta caa agc gtg aat att gat	4168
Lys Pro Ile Pro Thr Leu Tyr Lys Pro Leu Gln Ser Val Asn Ile Asp	
1300 1305 1310	
aca aaa gag cct tat aag gcc agt gtt gag cgc tct gat agc acg gcg	4216
Thr Lys Glu Pro Tyr Lys Ala Ser Val Glu Arg Ser Asp Ser Thr Ala	
1315 1320 1325	
gta ccg gcc gct agc gtt gtt tgt gaa gcc gtt gtt gca acg gaa gta	4264
Val Pro Ala Ala Ser Val Val Cys Glu Ala Val Val Ala Thr Glu Val	
1330 1335 1340 1345	
gca aag gct atg ctc gaa aaa ttt gat agt gac tca ttt gaa caa atg	4312
Ala Lys Ala Met Leu Glu Lys Phe Asp Ser Asp Ser Phe Glu Gln Met	
1350 1355 1360	
aaa gaa gca gtg aaa cgt tat cgt cta tat act caa aac ttt taa	4357
Lys Glu Ala Val Lys Arg Tyr Arg Leu Tyr Thr Gln Asn Phe	
1365 1370 1375	
tggaagaaag tcgcaagtat atggagggaa aaa atg aag aaa cgt att tta atc	4411
Met Lys Lys Arg Ile Leu Ile	
1380	
gta gga tta ggg cta atc ggg agt tca ctg gct ttg tgt atc aaa aaa	4459
Val Gly Leu Gly Leu Ile Gly Ser Ser Leu Ala Leu Cys Ile Lys Lys	
1385 1390 1395	
ggg cat cca aac agt gag att atc ggt ttc gat aat caa gcg gag gca	4507
Gly His Pro Asn Ser Glu Ile Ile Gly Phe Asp Asn Gln Ala Glu Ala	

Fig. 15A
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1400	1405	1410	
act gaa ttt gct aag aaa acg ggt cta att gat gag ata gct gaa tct			4555
Thr Glu Phe Ala Lys Lys Thr Gly Leu Ile Asp Glu Ile Ala Glu Ser			
1415	1420	1425 1430	
tta aca agt ggg gca aga cga gca gag att att ttt ctt tgt tcc cca			4603
Leu Thr Ser Gly Ala Arg Arg Ala Glu Ile Ile Phe Leu Cys Ser Pro			
	1435	1440 1445	
gtt aaa gca act tta gta caa cta gaa gaa tta aac caa tta tca cta			4651
Val Lys Ala Thr Leu Val Gln Leu Glu Glu Leu Asn Gln Leu Ser Leu			
	1450	1455 1460	
gaa act gct ctg atc aca gat gtg ggt agt acc aag gtg gaa att aat			4699
Glu Thr Ala Leu Ile Thr Asp Val Gly Ser Thr Lys Val Glu Ile Asn			
	1465	1470 1475	
cag tta gca aca aag ctt aac atg aaa aat ttt att ggt ggt cat cca			4747
Gln Leu Ala Thr Lys Leu Asn Met Lys Asn Phe Ile Gly Gly His Pro			
	1480	1485 1490	
atg gct ggt tca cat aaa tcc ggc gta aca gcc gct gat gaa cgt ttg			4795
Met Ala Gly Ser His Lys Ser Gly Val Thr Ala Ala Asp Glu Arg Leu			
	1495	1500 1505 1510	
ttt gaa aat gcc tac tat att ttt acc gat gac cat ggc gaa aaa aac			4843
Phe Glu Asn Ala Tyr Tyr Ile Phe Thr Asp Asp His Gly Glu Lys Asn			
	1515	1520 1525	
aaa cag att cag gag tta caa acg tta cta aaa gga acg cat gcg aag			4891
Lys Gln Ile Gln Glu Leu Gln Thr Leu Leu Lys Gly Thr His Ala Lys			
	1530	1535 1540	
ttt att acg atg cct gca cag gaa cat gat gaa att act ggt gct cta			4939
Phe Ile Thr Met Pro Ala Gln Glu His Asp Glu Ile Thr Gly Ala Leu			
	1545	1550 1555	
agt cac ttg cca cat att gtt gcc gca gcg tta gtg aac gaa agt cag			4987
Ser His Leu Pro His Ile Val Ala Ala Ala Leu Val Asn Glu Ser Gln			
	1560	1565 1570	
caa ctg aat acc act tac cct aga gcg cag cag cta gcg gct gga gga			5035
Gln Leu Asn Thr Thr Tyr Pro Arg Ala Gln Gln Leu Ala Ala Gly Gly			
	1575	1580 1585 1590	
ttc aga gat att act cga att gct tcc tct gat gca acg atg tgg acg			5083
Phe Arg Asp Ile Thr Arg Ile Ala Ser Ser Asp Ala Thr Met Trp Thr			
	1595	1600 1605	
gat att tta tta agc aat cgc tta gta tta ttg gac tta cta gaa aat			5131
Asp Ile Leu Leu Ser Asn Arg Leu Val Leu Leu Asp Leu Leu Glu Asn			
	1610	1615 1620	
tgg caa aaa gag atg act act gtt tgc caa tgg tta aca gaa aaa aat			5179
Trp Gln Lys Glu Met Thr Thr Val Cys Gln Trp Leu Thr Glu Lys Asn			
	1625	1630 1635	
gcc cca gct att cgt aat ttt ttt gat aag gcc aaa gaa aca cgt gct			5227
Ala Pro Ala Ile Arg Asn Phe Phe Asp Lys Ala Lys Glu Thr Arg Ala			
	1640	1645 1650	

Fig. 15A
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caa ttg cct att cat aaa gaa ggc gca atc cca gct ttc tat gat ctg	5275
Gln Leu Pro Ile His Lys Glu Gly Ala Ile Pro Ala Phe Tyr Asp Leu	
1655 1660 1665 1670	
ttt gtt gat gta cca gat caa cca gga atc att gct gaa att acg caa	5323
Phe Val Asp Val Pro Asp Gln Pro Gly Ile Ile Ala Glu Ile Thr Gln	
1675 1680 1685	
att tta ggc gaa gcg gac ctt tct ctt aca aat att aaa att tta gaa	5371
Ile Leu Gly Glu Ala Asp Leu Ser Leu Thr Asn Ile Lys Ile Leu Glu	
1690 1695 1700	
acg aga gaa gaa atc tat ggg att ctt caa ttg tct ttt aaa aat caa	5419
Thr Arg Glu Glu Ile Tyr Gly Ile Leu Gln Leu Ser Phe Lys Asn Gln	
1705 1710 1715	
cca gac tgc caa gct gca aaa caa att tta tct aaa aaa acg aac tat	5467
Pro Asp Cys Gln Ala Ala Lys Gln Ile Leu Ser Lys Lys Thr Asn Tyr	
1720 1725 1730	
acg tgt tac gaa aaa taa gaggtg atg agg gtg caa cta cgt aca aat	5515
Thr Cys Tyr Glu Lys * Met Arg Val Gln Leu Arg Thr Asn	
1735 1740 1745	
gtg aag cat tta caa ggg act ctg atg gtt cct agc gac aaa tcg att	5563
Val Lys His Leu Gln Gly Thr Leu Met Val Pro Ser Asp Lys Ser Ile	
1750 1755 1760	
tcc cat aga agt att atg ttt gga gcg att tct tct gga aaa acg acg	5611
Ser His Arg Ser Ile Met Phe Gly Ala Ile Ser Ser Gly Lys Thr Thr	
1765 1770 1775	
att aca aat ttt cta aga ggc gaa gat tgt tta agt acc tta gcg gcg	5659
Ile Thr Asn Phe Leu Arg Gly Glu Asp Cys Leu Ser Thr Leu Ala Ala	
1780 1785 1790 1795	
ttt cgt tct tta ggt gtg aac att gaa gat gac ggg acg aca atc acc	5707
Phe Arg Ser Leu Gly Val Asn Ile Glu Asp Asp Gly Thr Thr Ile Thr	
1800 1805 1810	
gtt gag ggg cga gga ttt gca ggc tta aaa aag gcg aag aat aca att	5755
Val Glu Gly Arg Gly Phe Ala Gly Leu Lys Lys Ala Lys Asn Thr Ile	
1815 1820 1825	
gat gtt gga aat tca ggg aca aca att cgt ctg atg ctg ggc att tta	5803
Asp Val Gly Asn Ser Gly Thr Thr Ile Arg Leu Met Leu Gly Ile Leu	
1830 1835 1840	
gct ggc tgt ccc ttt gaa acg cgc cta gct ggt gat gcg tct att gcc	5851
Ala Gly Cys Pro Phe Glu Thr Arg Leu Ala Gly Asp Ala Ser Ile Ala	
1845 1850 1855	
aaa cga cca atg aat cgt gta atg ctt cct tta aac caa atg gga gcg	5899
Lys Arg Pro Met Asn Arg Val Met Leu Pro Leu Asn Gln Met Gly Ala	
1860 1865 1870 1875	
gaa tgt caa ggg gtt cag caa acg gag ttt ccg cca att tct att cgc	5947
Glu Cys Gln Gly Val Gln Gln Thr Glu Phe Pro Pro Ile Ser Ile Arg	
1880 1885 1890	

Fig. 15A
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ggg act caa aat ttg caa ccg att gac tac aca atg cct gtt gca agt	5995
Gly Thr Gln Asn Leu Gln Pro Ile Asp Tyr Thr Met Pro Val Ala Ser	
1895 1900 1905	
gct caa gtt aaa tcg gct att tta ttc gcc gct ttg caa gcc gag ggc	6043
Ala Gln Val Lys Ser Ala Ile Leu Phe Ala Ala Leu Gln Ala Glu Gly	
1910 1915 1920	
act tct gta gtg gtt gag aaa gaa aag aca cgt gat cat aca gaa gag	6091
Thr Ser Val Val Val Glu Lys Glu Lys Thr Arg Asp His Thr Glu Glu	
1925 1930 1935	
atg att cga caa ttt ggt ggg aca ctt gaa gta gac ggt aaa aaa att	6139
Met Ile Arg Gln Phe Gly Gly Thr Leu Glu Val Asp Gly Lys Lys Ile	
1940 1945 1950 1955	
atg tta act gga ccg caa caa tta aca ggt caa aat gtg gta gtt cct	6187
Met Leu Thr Gly Pro Gln Gln Leu Thr Gly Gln Asn Val Val Val Pro	
1960 1965 1970	
ggt gat atc tct tct gca gct ttc ttt tta gtt gcg ggt tta gta gtc	6235
Gly Asp Ile Ser Ser Ala Ala Phe Phe Leu Val Ala Gly Leu Val Val	
1975 1980 1985	
cca gat agc gag ata ctt ctg aaa aat gtt ggc tta aat caa acg cgg	6283
Pro Asp Ser Glu Ile Leu Leu Lys Asn Val Gly Leu Asn Gln Thr Arg	
1990 1995 2000	
aca ggt att tta gat gtg att aaa aac atg ggc ggt tcc gtc act att	6331
Thr Gly Ile Leu Asp Val Ile Lys Asn Met Gly Gly Ser Val Thr Ile	
2005 2010 2015	
tta aat gaa gat gag gcc aat cat tct ggc gat tta ctt gta aaa acg	6379
Leu Asn Glu Asp Glu Ala Asn His Ser Gly Asp Leu Leu Val Lys Thr	
2020 2025 2030 2035	
agt caa tta aca gct aca gag att ggt ggc gct att atc cca cgt tta	6427
Ser Gln Leu Thr Ala Thr Glu Ile Gly Gly Ala Ile Ile Pro Arg Leu	
2040 2045 2050	
att gat gag tta ccg att att gct ttg tta gct act cag gct act ggc	6475
Ile Asp Glu Leu Pro Ile Ile Ala Leu Leu Ala Thr Gln Ala Thr Gly	
2055 2060 2065	
acg aca atc att cga gat gca gaa gaa ttg aaa gtc aaa gaa acc aat	6523
Thr Thr Ile Ile Arg Asp Ala Glu Glu Leu Lys Val Lys Glu Thr Asn	
2070 2075 2080	
cgg att gat gca gta gcg aaa gaa tta aca att tta ggc gcc gac atc	6571
Arg Ile Asp Ala Val Ala Lys Glu Leu Thr Ile Leu Gly Ala Asp Ile	
2085 2090 2095	
acg cct act gat gat ggc tta att ata cat gga cca act tct tta cat	6619
Thr Pro Thr Asp Asp Gly Leu Ile Ile His Gly Pro Thr Ser Leu His	
2100 2105 2110 2115	
ggt gga aga gtt acc agt tat ggg gat cat cgt atc ggg atg atg tta	6667
Gly Gly Arg Val Thr Ser Tyr Gly Asp His Arg Ile Gly Met Met Leu	
2120 2125 2130	
caa att gct gca tta ctt gta aaa gaa ggc act gtt gaa tta gat aag	6715

Fig. 15A
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Gln Ile Ala Ala Leu Leu Val Lys Glu Gly Thr Val Glu Leu Asp Lys	
2135	2140 2145
gct gaa gca gtt tca gtt tct tat cca gca ttt ttt gac gac tta gaa	6763
Ala Glu Ala Val Ser Val Ser Tyr Pro Ala Phe Phe Asp Asp Leu Glu	
2150	2155 2160
cgt tta agt tgt taa cgaaggagga taacga acc atg gaa agc att gtt tta	6815
Arg Leu Ser Cys *	Thr Met Glu Ser Ile Val Leu
2165	2170
att ggt ttc atg ggt gcg ggt aaa aca act atc ggc caa agt ttg gcc	6863
Ile Gly Phe Met Gly Ala Gly Lys Thr Thr Ile Gly Gln Ser Leu Ala	
2175	2180 2185 2190
aat aaa ctg aag atg cct cat ctt gat tta gat aca gcg tta att gaa	6911
Asn Lys Leu Lys Met Pro His Leu Asp Leu Asp Thr Ala Leu Ile Glu	
2195	2200 2205
aaa ata gga cgc tca att cct gac tat ttc gaa aaa tat ggt gaa gca	6959
Lys Ile Gly Arg Ser Ile Pro Asp Tyr Phe Glu Lys Tyr Gly Glu Ala	
2210	2215 2220
gct ttc cga gaa cag gaa acc caa ctt tta aag gag ctg tca aaa aat	7007
Ala Phe Arg Glu Gln Glu Thr Gln Leu Leu Lys Glu Leu Ser Lys Asn	
2225	2230 2235
aca gcc gtc ctt tca act ggg ggc ggg att gtt gtc gga cca gaa aat	7055
Thr Ala Val Leu Ser Thr Gly Gly Gly Ile Val Val Gly Pro Glu Asn	
2240	2245 2250
cgt agc tta tta aaa tct ttt cag caa gtg att tat tta cat gcg aca	7103
Arg Ser Leu Leu Lys Ser Phe Gln Gln Val Ile Tyr Leu His Ala Thr	
2255	2260 2265 2270
cca gaa gag ctg tta aaa aga atc aca gaa gat act gaa aac caa cgg	7151
Pro Glu Glu Leu Leu Lys Arg Ile Thr Glu Asp Thr Glu Asn Gln Arg	
2275	2280 2285
ccc tta gct ata gaa cgt tct tca aaa gaa atc att act ttg ttt gag	7199
Pro Leu Ala Ile Glu Arg Ser Ser Lys Glu Ile Ile Thr Leu Phe Glu	
2290	2295 2300
tct cgt aaa aat ttt tat gaa gaa tgt gcg aag atg aca att gat acg	7247
Ser Arg Lys Asn Phe Tyr Glu Glu Cys Ala Lys Met Thr Ile Asp Thr	
2305	2310 2315
acc aat cgc tcg cca gaa gaa att atc aat gaa att ctg caa caa tta	7295
Thr Asn Arg Ser Pro Glu Glu Ile Ile Asn Glu Ile Leu Gln Gln Leu	
2320	2325 2330
aag gag tag agaaacg atg aaa gtt ggt tat tta ggt ccg att ggt tcc	7344
Lys Glu *	Met Lys Val Gly Tyr Leu Gly Pro Ile Gly Ser
2335	2340 2345
ttt acg tac agt gca acg ttg gct gct ttt cct gaa gct acg ttg atg	7392
Phe Thr Tyr Ser Ala Thr Leu Ala Ala Phe Pro Glu Ala Thr Leu Met	
2350	2355 2360
ccg tac gca tcg att cca gct tgc ttg aaa gca att gaa cag caa gaa	7440
Pro Tyr Ala Ser Ile Pro Ala Cys Leu Lys Ala Ile Glu Gln Gln Glu	

Fig. 15A
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2365	2370	2375	
gtg gca tgg agc att atc cca ata gaa aac acg att gaa gga act gtt			7488
Val Ala Trp Ser Ile Ile Pro Ile Glu Asn Thr Ile Glu Gly Thr Val			
2380	2385	2390	2395
aac gca tcg ata gat tat ttg tat cat caa gcg cag tta cct gtc caa			7536
Asn Ala Ser Ile Asp Tyr Leu Tyr His Gln Ala Gln Leu Pro Val Gln			
2400	2405		2410
gca gag tta gtt tta ccg att caa caa caa tta atg gtg gca aaa gag			7584
Ala Glu Leu Val Leu Pro Ile Gln Gln Gln Leu Met Val Ala Lys Glu			
2415	2420		2425
aat caa gcg atc tgg caa caa agt cag aaa att tta tca cat ccg caa			7632
Asn Gln Ala Ile Trp Gln Gln Ser Gln Lys Ile Leu Ser His Pro Gln			
2430	2435		2440
gca tta gct caa tcg cag atg ttt cta gag aaa aac ttt cca gaa gcg			7680
Ala Leu Ala Gln Ser Gln Met Phe Leu Glu Lys Asn Phe Pro Glu Ala			
2445	2450		2455
att tta gaa gca aca cct tca aca gct tac gcc gcc aaa tac att gca			7728
Ile Leu Glu Ala Thr Pro Ser Thr Ala Tyr Ala Ala Lys Tyr Ile Ala			
2460	2465	2470	2475
gaa cat cca gaa tta cct ttt gca gct att gca cca aaa ctt tct gcg			7776
Glu His Pro Glu Leu Pro Phe Ala Ala Ile Ala Pro Lys Leu Ser Ala			
2480	2485		2490
gaa atg tat gat ttg acc att gtt gaa aaa aat ata caa gat tta tcg			7824
Glu Met Tyr Asp Leu Thr Ile Val Glu Lys Asn Ile Gln Asp Leu Ser			
2495	2500		2505
gta aat caa acc cga ttt tgg gtt ctt ggt tct gaa aat tta gcg att			7872
Val Asn Gln Thr Arg Phe Trp Val Leu Gly Ser Glu Asn Leu Ala Ile			
2510	2515		2520
tct ttc ccg cta tct gag aaa aaa ata aca ctg gcg att acg atg cca			7920
Ser Phe Pro Leu Ser Glu Lys Lys Ile Thr Leu Ala Ile Thr Met Pro			
2525	2530		2535
agt aat gtt cct ggc tct tta cac aaa gta tta agc gtg ttt agt tgg			7968
Ser Asn Val Pro Gly Ser Leu His Lys Val Leu Ser Val Phe Ser Trp			
2540	2545	2550	2555
cga ggg att aat ctt agc aaa ata gaa tcg cgg ccg ttg aaa aca aag			8016
Arg Gly Ile Asn Leu Ser Lys Ile Glu Ser Arg Pro Leu Lys Thr Lys			
2560	2565		2570
cta gga gag tac ttc ttt tta atg gac tta gtg aaa gat caa cca gaa			8064
Leu Gly Glu Tyr Phe Phe Leu Met Asp Leu Val Lys Asp Gln Pro Glu			
2575	2580		2585
aaa tta att gaa gca gcc tta aca gaa ctg gaa ctc att ggt gca gaa			8112
Lys Leu Ile Glu Ala Ala Leu Thr Glu Leu Glu Leu Ile Gly Ala Glu			
2590	2595		2600
ata aaa att tta ggg gat tac ccg atc tat gtt ttg tcc aca ctt taa			8160
Ile Lys Ile Leu Gly Asp Tyr Pro Ile Tyr Val Leu Ser Thr Leu *			
2605	2610		2615

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Fig. 15A
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agagttaaaa atgaaaatga agcttactta ttagataaag tgagtttcat tttttattaa 8220
attacatatt tgtaatagga atttcctgtg aaatgaggta tcctaagaaa ggtgataaaa 8280
cacagaggta aaggagtgc acgatgagtc gtgtagatcg ttataaacat attcatgaaa 8340
tcttttc 8347

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Fig. 15A
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Figure 15B

ORF1

atgaaagaaa	taactggagc	cactcgttta	gctgggctat	tcgcgaaacc	cagccaacac	60
agtatttcac	cgttgattca	taatacagca	tttcaaaatt	taggagttga	tgctcggtat	120
ctggcgtttg	acgttggaca	agagacattg	ccacaagcaa	ttgaagcgat	tcgaacgttt	180
cacatgttag	gggccaactt	atcaatgccc	aataaagtgg	cggctgtaag	ttatatggat	240
gaactaagtc	ctaccgctca	actggttggc	gcaattaata	cgattgtcaa	caaagatgga	300
aaactttacg	gagacagcac	ggatggtact	ggttttatgt	ggagtttgaa	agagaaaaag	360
gttgacgttt	ttcagaataa	aatgaccatc	ttaggaacag	gtggtgcagc	cttatcaatc	420
attgcccaag	ctgctttaga	tggcgtgaaa	gaaatcgccg	tttacaacag	gaaaagcgcg	480
ggctttaacg	acagtcaaaa	aaaactggca	aatttcactg	aacgaacca	ctgtgtaatt	540
catttaaacg	athtagcgga	tactgaaaaa	ctagcaaaaag	atgttgctga	aagcgtcttg	600
ttagttaatg	caacgagtgt	gggtatgcat	ccacatgcgc	atagtagtcc	tatagaaaat	660
tatgcaatga	ttcaaccgaa	gttatttgtg	tatgatgcta	tttataatcc	cagagaaaca	720
cagttattaa	aagaagcccg	tttacgtggg	gcagaaacaa	gcaacggcct	ggacatgcta	780
ctttatcaag	gcgctgctgc	ttttgaacaa	tggacaggac	aaaaaatgcc	tgtatcagtc	840
gtaaaacgta	aaattgaaaa	tagataa				867

Figure 15C

ORF1

Met	Lys	Glu	Ile	Thr	Gly	Ala	Thr	Arg	Leu	Ala	Gly	Leu	Phe	Ala	Lys
1				5					10					15	
Pro	Ser	Gln	His	Ser	Ile	Ser	Pro	Leu	Ile	His	Asn	Thr	Ala	Phe	Gln
			20					25					30		
Asn	Leu	Gly	Val	Asp	Ala	Arg	Tyr	Leu	Ala	Phe	Asp	Val	Gly	Gln	Glu
		35					40				45				
Thr	Leu	Pro	Gln	Ala	Ile	Glu	Ala	Ile	Arg	Thr	Phe	His	Met	Leu	Gly
	50					55					60				
Ala	Asn	Leu	Ser	Met	Pro	Asn	Lys	Val	Ala	Ala	Val	Ser	Tyr	Met	Asp
65					70					75				80	
Glu	Leu	Ser	Pro	Thr	Ala	Gln	Leu	Val	Gly	Ala	Ile	Asn	Thr	Ile	Val
				85					90					95	
Asn	Lys	Asp	Gly	Lys	Leu	Tyr	Gly	Asp	Ser	Thr	Asp	Gly	Thr	Gly	Phe
			100					105					110		
Met	Trp	Ser	Leu	Lys	Glu	Lys	Lys	Val	Asp	Val	Phe	Gln	Asn	Lys	Met
	115						120					125			
Thr	Ile	Leu	Gly	Thr	Gly	Gly	Ala	Ala	Leu	Ser	Ile	Ile	Ala	Gln	Ala
	130					135						140			
Ala	Leu	Asp	Gly	Val	Lys	Glu	Ile	Ala	Val	Tyr	Asn	Arg	Lys	Ser	Ala
145					150					155				160	
Gly	Phe	Asn	Asp	Ser	Gln	Lys	Lys	Leu	Ala	Asn	Phe	Thr	Glu	Arg	Thr
			165					170					175		
Asn	Cys	Val	Ile	His	Leu	Asn	Asp	Leu	Ala	Asp	Thr	Glu	Lys	Leu	Ala
		180					185					190			
Lys	Asp	Val	Ala	Glu	Ser	Val	Leu	Leu	Val	Asn	Ala	Thr	Ser	Val	Gly
	195						200					205			
Met	His	Pro	His	Ala	His	Ser	Ser	Pro	Ile	Glu	Asn	Tyr	Ala	Met	Ile
	210					215					220				
Gln	Pro	Lys	Leu	Phe	Val	Tyr	Asp	Ala	Ile	Tyr	Asn	Pro	Arg	Glu	Thr
225					230					235				240	
Gln	Leu	Leu	Lys	Glu	Ala	Arg	Leu	Arg	Gly	Ala	Glu	Thr	Ser	Asn	Gly
			245						250					255	
Leu	Asp	Met	Leu	Leu	Tyr	Gln	Gly	Ala	Ala	Ala	Phe	Glu	Gln	Trp	Thr
			260					265				270			
Gly	Gln	Lys	Met	Pro	Val	Ser	Val	Val	Lys	Arg	Lys	Ile	Glu	Asn	Arg
		275					280					285			

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Figure 15D

ORF2

atgatcgtaa	ttatgaaaga	aaatgcaacc	gaaaagcaaa	tgaaacaagt	cattgattta	60
gtaacagggtg	caggcttaac	tactcaaaca	agtcaagata	atggaaaaac	agtgataggc	120
ttgattgggtg	atacagaaaa	attagttgaa	gcagagttaa	cagcattaga	aggcgtggag	180
aaaagtgtcc	gcatttcgtt	gtcttataaa	ctaacgagtc	gtttatttca	tccagagaat	240
acagtgggtg	atgtgaacgg	tgttaaaatc	ggtgacggca	gtatgaccat	gatggcgggc	300
ccttgttcaa	tcgaaagctt	agatcagatt	cgcgaatgtg	cgcgaattgc	taaagctgga	360
ggtgcaacaa	ttttacgagg	tggtgcattc	aaacctagaa	cgtcgccata	cgctttccaa	420
ggactagaag	aagaaggact	aaaatacatt	cgccaagcgg	ctgatgaatt	agatatgcaa	480
gtcattacag	aagtgatgga	tgaagcgaat	ttagaacttg	tcgcaaaaata	cagtgcatt	540
ttacaaatcg	gtgcgcgcaa	catgcaaaat	ttcaagttat	tacaagcggg	tggtaaaact	600
ggaaaaccta	ttggcttaaa	acgcgggatt	gctggtacga	ttgatgaatg	gctaaacgca	660
gctgaataca	ttgctgcgca	aggaaatttc	aatgtgatct	tcattgaacg	tgggattcgt	720
acgtacgaaa	ccgctacgcg	caatacactt	gatttaagt	cgggtgcctt	aattaaaaaa	780
ttaagtcatt	ttccaattat	tgttgatccg	agtcatgggtg	ttggtatctg	ggatttagta	840
ccgccaatgg	cccgagcagg	tgttgcttca	ggtgcggacg	gcttgattgt	agaaattcat	900
ccagatccag	cgaatgcgtg	gtcagatggg	ccacaatcct	tgaatgaaaa	aacttaccta	960
cgtatgatga	aagaagttca	tatcatcgaa	aaagcaatga	aagaaattaa	tgcttttagaa	1020
gattag						1026

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Figure 15E

ORF2

Met	Ile	Val	Ile	Met	Lys	Glu	Asn	Ala	Thr	Glu	Lys	Gln	Met	Lys	Gln
1				5					10					15	
Val	Ile	Asp	Leu	Val	Thr	Gly	Ala	Gly	Leu	Thr	Thr	Gln	Thr	Ser	Gln
		20						25					30		
Asp	Asn	Gly	Lys	Thr	Val	Ile	Gly	Leu	Ile	Gly	Asp	Thr	Glu	Lys	Leu
	35					40					45				
Val	Glu	Ala	Glu	Leu	Thr	Ala	Leu	Glu	Gly	Val	Glu	Lys	Ser	Val	Arg
	50					55					60				
Ile	Ser	Leu	Ser	Tyr	Lys	Leu	Thr	Ser	Arg	Leu	Phe	His	Pro	Glu	Asn
65				70					75					80	
Thr	Val	Val	Asp	Val	Asn	Gly	Val	Lys	Ile	Gly	Asp	Gly	Ser	Met	Thr
			85					90						95	
Met	Met	Ala	Gly	Pro	Cys	Ser	Ile	Glu	Ser	Leu	Asp	Gln	Ile	Arg	Glu
		100						105					110		
Cys	Ala	Arg	Ile	Ala	Lys	Ala	Gly	Gly	Ala	Thr	Ile	Leu	Arg	Gly	Gly
		115					120					125			
Ala	Phe	Lys	Pro	Arg	Thr	Ser	Pro	Tyr	Ala	Phe	Gln	Gly	Leu	Glu	Glu
	130				135						140				
Glu	Gly	Leu	Lys	Tyr	Ile	Arg	Gln	Ala	Ala	Asp	Glu	Leu	Asp	Met	Gln
145				150						155					160
Val	Ile	Thr	Glu	Val	Met	Asp	Glu	Ala	Asn	Leu	Glu	Leu	Val	Ala	Lys
			165					170						175	
Tyr	Ser	Asp	Ile	Leu	Gln	Ile	Gly	Ala	Arg	Asn	Met	Gln	Asn	Phe	Lys
		180					185						190		
Leu	Leu	Gln	Ala	Val	Gly	Lys	Thr	Gly	Lys	Pro	Ile	Gly	Leu	Lys	Arg
	195					200						205			
Gly	Ile	Ala	Gly	Thr	Ile	Asp	Glu	Trp	Leu	Asn	Ala	Ala	Glu	Tyr	Ile
	210				215						220				
Ala	Ala	Gln	Gly	Asn	Phe	Asn	Val	Ile	Phe	Ile	Glu	Arg	Gly	Ile	Arg
225				230						235				240	
Thr	Tyr	Glu	Thr	Ala	Thr	Arg	Asn	Thr	Leu	Asp	Leu	Ser	Ala	Val	Pro
			245					250						255	
Leu	Ile	Lys	Lys	Leu	Ser	His	Phe	Pro	Ile	Ile	Val	Asp	Pro	Ser	His
		260					265						270		
Gly	Val	Gly	Ile	Trp	Asp	Leu	Val	Pro	Pro	Met	Ala	Arg	Ala	Gly	Val
	275					280						285			
Ala	Ser	Gly	Ala	Asp	Gly	Leu	Ile	Val	Glu	Ile	His	Pro	Asp	Pro	Ala
	290				295						300				
Asn	Ala	Trp	Ser	Asp	Gly	Pro	Gln	Ser	Leu	Asn	Glu	Lys	Thr	Tyr	Leu
305				310						315					320
Arg	Met	Met	Lys	Glu	Val	His	Ile	Ile	Glu	Lys	Ala	Met	Lys	Glu	Ile
			325						330					335	
Asn	Ala	Leu	Glu	Asp											
			340												

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Figure 15F

ORF3

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atgaaattaa ccgtaacggt acctacacat tcatatgatt taaccatcga aacagggtgcc 60
ttagataaaa ttggcacctg ggtacgtagc ctgtggcagc cacaacgggt agcgattatt 120
accgatgaaa cgggtgaataa attatatggc gcagctgttg agaaagaatt gcaagctgct 180
ggttttgaaa catcattgat tgctgtagcg gcagggtgaac aaagtaagag cctcgaaata 240
gctcaactgc tttatgattt tttagcggaa cagcaattga ctggaagtga tgggtctaatt 300
gctttagggt gaggcgttgt gggagatcta gctggatttg tcgcttcaac ctatatgcgc 360
ggtattcact ttttgcaagt accaacaacc ttactggcac aagtagatag tagcattgga 420
ggtaaaacag cggttaatac taaaaaagcc aaaaatcttg tcggtacttt tgcccaacca 480
gatgggggtt taattgatcc taatacactt aaaacattag aacctagacg tgtgcgtgaa 540
ggaattgcag aaattgtaaa atcagcagct atcgctgatg ttgaattgtg gcaccgttta 600
tcctcttttg aaaatgaaca agatttagtg gcacatgcag aagaaattat cacggcctgt 660
tgcaagatta aacgtgatgt cgtcgaagaa gatgaattag atttgggctt acgtttgatt 720
ctgaattttg ggcatacgat cggccacgca ttagaaaata cagctgggta cgggggtgatt 780
gctcacgggt aaggcgtttc tttaggaatg attcaaataa ctcaagtcgc agaacaacaa 840
gggctttccc cacttgggac tacccaagag ttggtcacca tgctagaaaa gttccattta 900
ccagtaacca cagatcgttg gtcagaagaa cgtctctatc aagcaattac acatgataaa 960
aaaacacgtg ggggacagat taaaatcatt gtcttagaaa aaattgggtca agcgaaaatt 1020
gtctctttac caacggaaga aattcgagca tttttaaaca gagaaggagg aatttaa 1077

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Figure 15G

ORF3

Met	Lys	Leu	Thr	Val	Thr	Leu	Pro	Thr	His	Ser	Tyr	Asp	Leu	Thr	Ile
1				5					10					15	
Glu	Thr	Gly	Ala	Leu	Asp	Lys	Ile	Gly	Thr	Trp	Val	Arg	Ser	Leu	Trp
			20					25				30			
Gln	Pro	Gln	Arg	Val	Ala	Ile	Ile	Thr	Asp	Glu	Thr	Val	Asn	Lys	Leu
		35				40						45			
Tyr	Gly	Ala	Ala	Val	Glu	Lys	Glu	Leu	Gln	Ala	Ala	Gly	Phe	Glu	Thr
	50					55					60				
Ser	Leu	Ile	Ala	Val	Ala	Ala	Gly	Glu	Gln	Ser	Lys	Ser	Leu	Glu	Ile
65					70				75					80	
Ala	Gln	Leu	Leu	Tyr	Asp	Phe	Leu	Ala	Glu	Gln	Gln	Leu	Thr	Arg	Ser
				85					90					95	
Asp	Gly	Leu	Ile	Ala	Leu	Gly	Gly	Gly	Val	Val	Gly	Asp	Leu	Ala	Gly
			100					105					110		
Phe	Val	Ala	Ser	Thr	Tyr	Met	Arg	Gly	Ile	His	Phe	Leu	Gln	Val	Pro
		115					120					125			
Thr	Thr	Leu	Leu	Ala	Gln	Val	Asp	Ser	Ser	Ile	Gly	Gly	Lys	Thr	Ala
	130					135						140			
Val	Asn	Thr	Lys	Lys	Ala	Lys	Asn	Leu	Val	Gly	Thr	Phe	Ala	Gln	Pro
145					150					155				160	
Asp	Gly	Val	Leu	Ile	Asp	Pro	Asn	Thr	Leu	Lys	Thr	Leu	Glu	Pro	Arg
			165					170					175		
Arg	Val	Arg	Glu	Gly	Ile	Ala	Glu	Ile	Val	Lys	Ser	Ala	Ala	Ile	Ala
			180					185					190		
Asp	Val	Glu	Leu	Trp	His	Arg	Leu	Ser	Ser	Leu	Glu	Asn	Glu	Gln	Asp
		195					200					205			
Leu	Val	Ala	His	Ala	Glu	Glu	Ile	Ile	Thr	Ala	Cys	Lys	Ile	Lys	
	210					215					220				
Arg	Asp	Val	Val	Glu	Glu	Asp	Glu	Leu	Asp	Leu	Gly	Leu	Arg	Leu	Ile
225					230					235				240	
Leu	Asn	Phe	Gly	His	Thr	Ile	Gly	His	Ala	Leu	Glu	Asn	Thr	Ala	Gly
			245						250					255	
Tyr	Gly	Val	Ile	Ala	His	Gly	Glu	Gly	Val	Ser	Leu	Gly	Met	Ile	Gln
		260						265					270		
Ile	Thr	Gln	Val	Ala	Glu	Gln	Gln	Gly	Leu	Ser	Pro	Leu	Gly	Thr	Thr
		275					280					285			
Gln	Glu	Leu	Val	Thr	Met	Leu	Glu	Lys	Phe	His	Leu	Pro	Val	Thr	Thr
	290					295					300				
Asp	Arg	Trp	Ser	Glu	Glu	Arg	Leu	Tyr	Gln	Ala	Ile	Thr	His	Asp	Lys
305					310					315				320	
Lys	Thr	Arg	Gly	Gly	Gln	Ile	Lys	Ile	Ile	Val	Leu	Glu	Lys	Ile	Gly
			325						330					335	
Gln	Ala	Lys	Ile	Val	Ser	Leu	Pro	Thr	Glu	Glu	Ile	Arg	Ala	Phe	Leu
			340					345					350		
Asn	Arg	Glu	Gly	Gly	Ile										
		355													

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Figure 15H

ORF4
atgcgccttta ttacagcagg cgaatcacat ggacctgaat taactgctat tattgaaggc 60
ttaccagccg gcttgccctt aagtagcgaa gagattaacc gagaattagc aagacgtcaa 120
ggcgggttac gtcgtggggg acggatgaaa attgaaaaag accaagtacg tattacttcg 180
ggtattcggc atggtaaaac acttggtcta ccagtaacgt tgattgtcga aaacaaagac 240
tgaaaaaatt ggacctcgt gatgtcagta gagccagttc ctgaaaaaca aaagaaaatc 300
cgccgcgtca gcaaaccacg tccaggacat gctgatttag tcggtggcat gaaatatcaa 360
catgatgatt tacggaatgt tttagaacgg tcttcggcac gagaaacaac gatgcgtgtg 420
gcgattggtg cggttgctaa aaaactctta gctgaactgg atatccaagt cgctgggcat 480
gtcgcggtat taggtgggat tgaagctacg atccctgaaa atttaacgat tcgtgaaatt 540
caagaacgat ctgaacaatc tgccgttcgc gtattagatc cttccgtaga agaaaaaatg 600
aaagaactaa ttgaccaaac caagaaaaat ggcgatacaa ttggtggggt agtagaagta 660
cttggtgggtg gcgttccagc tggcttaggt agctatgtcc aatgggatcg taaactagat 720
gccaaaattg cgcaagcagt tgtaagcatc aacgctttta cagggtgctga gtttggcatt 780
ggatttgaaa tggcacaacg ccctggtagt caactgatgg acgagattgt ttgggacgaa 840
agtactggtt ataccagaac ttccaacaat ttaggcggtt ttgaaggagg aatgaccaac 900
ggaatgccaa tcatcgttcg tgggtgtcatg aaacctattc caaccttta taaaccatta 960
caaagcgtga atattgatac aaaagagcct tataaggcca gtgttgagcg ctctgatagc 1020
acggcggtag cggcgcgtag cgttgtttgt gaagccgttg ttgcaacgga agtagcaaag 1080
gctatgctcg aaaaatttga tagtgactca tttgaacaaa tgaaagaagc agtgaaacgt 1140
tatcgtctat atactcaaaa cttttaa 1167

Figure 15I

ORF4

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Met Arg Phe Ile Thr Ala Gly Glu Ser His Gly Pro Glu Leu Thr Ala
1      5      10      15
Ile Ile Glu Gly Leu Pro Ala Gly Leu Pro Leu Ser Ser Glu Glu Ile
20      25      30
Asn Arg Glu Leu Ala Arg Arg Gln Gly Gly Tyr Gly Arg Gly Gly Arg
35      40      45
Met Lys Ile Glu Lys Asp Gln Val Arg Ile Thr Ser Gly Ile Arg His
50      55      60
Gly Lys Thr Leu Gly Ser Pro Val Thr Leu Ile Val Glu Asn Lys Asp
65      70      75      80
Trp Lys Asn Trp Thr Ser Val Met Ser Val Glu Pro Val Pro Glu Lys
85      90      95
Gln Lys Lys Ile Arg Arg Val Ser Lys Pro Arg Pro Gly His Ala Asp
100     105     110
Leu Val Gly Gly Met Lys Tyr Gln His Asp Asp Leu Arg Asn Val Leu
115     120     125
Glu Arg Ser Ser Ala Arg Glu Thr Thr Met Arg Val Ala Ile Gly Ala
130     135     140
Val Ala Lys Lys Leu Leu Ala Glu Leu Asp Ile Gln Val Ala Gly His
145     150     155     160
Val Ala Val Leu Gly Gly Ile Glu Ala Thr Ile Pro Glu Asn Leu Thr
165     170     175
Ile Arg Glu Ile Gln Glu Arg Ser Glu Gln Ser Ala Val Arg Val Leu
180     185     190
Asp Pro Ser Val Glu Glu Lys Met Lys Glu Leu Ile Asp Gln Thr Lys
195     200     205
Lys Asn Gly Asp Thr Ile Gly Gly Val Val Glu Val Leu Val Gly Gly
210     215     220
Val Pro Ala Gly Leu Gly Ser Tyr Val Gln Trp Asp Arg Lys Leu Asp
225     230     235     240
Ala Lys Ile Ala Gln Ala Val Val Ser Ile Asn Ala Phe Thr Gly Ala
245     250     255
Glu Phe Gly Ile Gly Phe Glu Met Ala Gln Arg Pro Gly Ser Gln Leu
260     265     270
Met Asp Glu Ile Val Trp Asp Glu Ser Thr Gly Tyr Thr Arg Thr Ser
275     280     285
Asn Asn Leu Gly Gly Phe Glu Gly Gly Met Thr Asn Gly Met Pro Ile
290     295     300
Ile Val Arg Gly Val Met Lys Pro Ile Pro Thr Leu Tyr Lys Pro Leu
305     310     315     320
Gln Ser Val Asn Ile Asp Thr Lys Glu Pro Tyr Lys Ala Ser Val Glu
325     330     335
Arg Ser Asp Ser Thr Ala Val Pro Ala Ala Ser Val Val Cys Glu Ala
340     345     350
Val Val Ala Thr Glu Val Ala Lys Ala Met Leu Glu Lys Phe Asp Ser
355     360     365
Asp Ser Phe Glu Gln Met Lys Glu Ala Val Lys Arg Tyr Arg Leu Tyr
370     375     380
Thr Gln Asn Phe
385

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Figure 15J

ORF5

atgaagaaac	gtattttaat	cgtaggatta	gggctaatacg	ggagttcact	ggctttgtgt	60
atcaaaaaag	ggcatccaaa	cagtgaagatt	atcggtttcg	ataatcaagc	ggaggcaact	120
gaatttgcta	agaaaacggg	tctaattgat	gagatagctg	aatctttaac	aagtggggca	180
agacgagcag	agattatfff	tctttgttcc	ccagttaaag	caactttagt	acaactagaa	240
gaattaaacc	aattatcact	agaaactgct	ctgatcacag	atgtgggtag	taccaagggtg	300
gaaattaatc	agttagcaac	aaagcttaac	atgaaaaatt	ttattggtgg	tcatccaatg	360
gctggttcac	ataaatccgg	cgtaacagcc	gctgatgaac	gtttgtttga	aaatgcctac	420
tatatftrta	ccgatgacca	tggcgaaaaa	aacaaacaga	ttcaggagtt	acaaacgtta	480
ctaaaaaggaa	cgcatgcgaa	gtttattacg	atgcctgcac	aggaacatga	tgaaattact	540
ggtgctctaa	gtcacttgcc	acatattggt	gccgcagcgt	tagtgaacga	aagtcagcaa	600
ctgaatacca	cttaccctag	agcgcagcag	ctagcggctg	gaggattcag	agatattact	660
cgaattgctt	cctctgatgc	aacgatgtgg	acggatattt	tattaagcaa	tcgcttagta	720
ttattggact	tactagaaaa	ttggcaaaaa	gagatgacta	ctgtttgcca	atggttaaca	780
gaaaaaaatg	ccccagctat	tcgtaatfff	tttgataagg	ccaaagaaac	acgtgctcaa	840
ttgcctattc	ataaagaagg	cgcaatccca	gctttctatg	atctgtttgt	tgatgtacca	900
gatcaaccag	gaatcattgc	tgaaattacg	caaatttttag	gcgaagcgga	cctttctctt	960
acaaatatta	aaatftrtaga	aacgagagaa	gaaatctatg	ggattcttca	attgtctfff	1020
aaaaatcaac	cagactgccca	agctgcaaaa	caaattttat	ctaaaaaaac	gaactatacg	1080
tgttacgaaa	aataa					1095

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Figure 15K

ORF5

Met	Lys	Lys	Arg	Ile	Leu	Ile	Val	Gly	Leu	Gly	Leu	Ile	Gly	Ser	Ser	1	5	10	15
Leu	Ala	Leu	Cys	Ile	Lys	Lys	Gly	His	Pro	Asn	Ser	Glu	Ile	Ile	Gly	20	25	30	
Phe	Asp	Asn	Gln	Ala	Glu	Ala	Thr	Glu	Phe	Ala	Lys	Lys	Thr	Gly	Leu	35	40	45	
Ile	Asp	Glu	Ile	Ala	Glu	Ser	Leu	Thr	Ser	Gly	Ala	Arg	Arg	Ala	Glu	50	55	60	
Ile	Ile	Phe	Leu	Cys	Ser	Pro	Val	Lys	Ala	Thr	Leu	Val	Gln	Leu	Glu	65	70	75	80
Glu	Leu	Asn	Gln	Leu	Ser	Leu	Glu	Thr	Ala	Leu	Ile	Thr	Asp	Val	Gly	85	90	95	
Ser	Thr	Lys	Val	Glu	Ile	Asn	Gln	Leu	Ala	Thr	Lys	Leu	Asn	Met	Lys	100	105	110	
Asn	Phe	Ile	Gly	Gly	His	Pro	Met	Ala	Gly	Ser	His	Lys	Ser	Gly	Val	115	120	125	
Thr	Ala	Ala	Asp	Glu	Arg	Leu	Phe	Glu	Asn	Ala	Tyr	Tyr	Ile	Phe	Thr	130	135	140	
Asp	Asp	His	Gly	Glu	Lys	Asn	Lys	Gln	Ile	Gln	Glu	Leu	Gln	Thr	Leu	145	150	155	160
Leu	Lys	Gly	Thr	His	Ala	Lys	Phe	Ile	Thr	Met	Pro	Ala	Gln	Glu	His	165	170	175	
Asp	Glu	Ile	Thr	Gly	Ala	Leu	Ser	His	Leu	Pro	His	Ile	Val	Ala	Ala	180	185	190	
Ala	Leu	Val	Asn	Glu	Ser	Gln	Gln	Leu	Asn	Thr	Thr	Tyr	Pro	Arg	Ala	195	200	205	
Gln	Gln	Leu	Ala	Ala	Gly	Gly	Phe	Arg	Asp	Ile	Thr	Arg	Ile	Ala	Ser	210	215	220	
Ser	Asp	Ala	Thr	Met	Trp	Thr	Asp	Ile	Leu	Leu	Ser	Asn	Arg	Leu	Val	225	230	235	240
Leu	Leu	Asp	Leu	Leu	Glu	Asn	Trp	Gln	Lys	Glu	Met	Thr	Thr	Val	Cys	245	250	255	
Gln	Trp	Leu	Thr	Glu	Lys	Asn	Ala	Pro	Ala	Ile	Arg	Asn	Phe	Phe	Asp	260	265	270	
Lys	Ala	Lys	Glu	Thr	Arg	Ala	Gln	Leu	Pro	Ile	His	Lys	Glu	Gly	Ala	275	280	285	
Ile	Pro	Ala	Phe	Tyr	Asp	Leu	Phe	Val	Asp	Val	Pro	Asp	Gln	Pro	Gly	290	295	300	
Ile	Ile	Ala	Glu	Ile	Thr	Gln	Ile	Leu	Gly	Glu	Ala	Asp	Leu	Ser	Leu	305	310	315	320
Thr	Asn	Ile	Lys	Ile	Leu	Glu	Thr	Arg	Glu	Glu	Ile	Tyr	Gly	Ile	Leu	325	330	335	
Gln	Leu	Ser	Phe	Lys	Asn	Gln	Pro	Asp	Cys	Gln	Ala	Ala	Lys	Gln	Ile	340	345	350	
Leu	Ser	Lys	Lys	Thr	Asn	Tyr	Thr	Cys	Tyr	Glu	Lys					355	360		

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Figure 15L

ORF6

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atgagggtgc aactacgtac aaatgtgaag catttacaag ggactctgat ggttcctagc 60
gacaaatcga tttcccatag aagtattatg tttggagcga tttcttctgg aaaaacgacg 120
attacaaatt ttctaagagg cgaagattgt ttaagtacct tagcggcggt tcgttcttta 180
ggtgtgaaca ttgaagatga cgggacgaca atcaccgttg agggggcgagg atttgaggc 240
ttaaaaaagg cgaagaatac aattgatgtt ggaaattcag ggacaacaat tcgtctgatg 300
ctgggcattt tagctggctg tccctttgaa acgcgcctag ctggtgatgc gtctattgcc 360
aaacgaccaa tgaatcgtgt aatgcttcct ttaaaccaaa tgggagcgga atgtcaagg 420
gttcagcaaa cggagtttcc gccaatctt attcgcggga ctcaaaattt gcaaccgatt 480
gactacacaa tgctgttgc aagtgtctca gttaaactcg ctattttatt cgccgctttg 540
caagccgagg gcacttctgt agtggttgag aaagaaaaga cacgtgatca tacagaagag 600
atgattcgac aatttggttg gacacttgaa gtagacggta aaaaaattat gttactgga 660
ccgcaacaat taacaggtca aaatgtggtg gttcctgggtg atatctcttc tgcagctttc 720
tttttagttg cgggtttagt agtcccagat agcgagatac ttctgaaaaa tgttggctta 780
aatcaaacgc ggacaggat tttagatgtg attaaaaaca tgggcgggtt cgctactatt 840
ttaaatgaag atgaggccaa tcattctggc gatttacttg taaaaacgag tcaattaaca 900
gctacagaga ttggtggcgc tattatccca cgtttaattg atgagttacc gattattgct 960
ttgtagcta ctcaggctac tggcacgaca atcattcgag atgcagaaga attgaaagtc 1020
aaagaaacca atcggattga tgcagtagcg aaagaattaa caattttagg cgccgacatc 1080
acgcctactg atgatggctt aattatacat ggaccaactt ctttacatgg tggaagagtt 1140
accagttatg gggatcatcg tatcgggatg atgttacaaa ttgctgcatt acttgtaaaa 1200
gaaggcactg ttgaattaga taaggctgaa gcagtttcag tttcttatcc agcatttttt 1260
gacgacttag aacgtttaag ttgttaa 1287

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Figure 15M

ORF6

Met	Arg	Val	Gln	Leu	Arg	Thr	Asn	Val	Lys	His	Leu	Gln	Gly	Thr	Leu
1				5					10					15	
Met	Val	Pro	Ser	Asp	Lys	Ser	Ile	Ser	His	Arg	Ser	Ile	Met	Phe	Gly
			20					25				30			
Ala	Ile	Ser	Ser	Gly	Lys	Thr	Thr	Ile	Thr	Asn	Phe	Leu	Arg	Gly	Glu
		35				40					45				
Asp	Cys	Leu	Ser	Thr	Leu	Ala	Phe	Arg	Ser	Leu	Gly	Val	Asn	Ile	
50					55					60					
Glu	Asp	Asp	Gly	Thr	Thr	Ile	Thr	Val	Glu	Gly	Arg	Gly	Phe	Ala	Gly
65				70					75					80	
Leu	Lys	Lys	Ala	Lys	Asn	Thr	Ile	Asp	Val	Gly	Asn	Ser	Gly	Thr	Thr
			85					90					95		
Ile	Arg	Leu	Met	Leu	Gly	Ile	Leu	Ala	Gly	Cys	Pro	Phe	Glu	Thr	Arg
		100					105					110			
Leu	Ala	Gly	Asp	Ala	Ser	Ile	Ala	Lys	Arg	Pro	Met	Asn	Arg	Val	Met
	115						120					125			
Leu	Pro	Leu	Asn	Gln	Met	Gly	Ala	Glu	Cys	Gln	Gly	Val	Gln	Gln	Thr
	130				135						140				
Glu	Phe	Pro	Pro	Ile	Ser	Ile	Arg	Gly	Thr	Gln	Asn	Leu	Gln	Pro	Ile
145				150					155					160	
Asp	Tyr	Thr	Met	Pro	Val	Ala	Ser	Ala	Gln	Val	Lys	Ser	Ala	Ile	Leu
			165					170					175		
Phe	Ala	Ala	Leu	Gln	Ala	Glu	Gly	Thr	Ser	Val	Val	Val	Glu	Lys	Glu
		180					185					190			
Lys	Thr	Arg	Asp	His	Thr	Glu	Glu	Met	Ile	Arg	Gln	Phe	Gly	Gly	Thr
	195					200					205				
Leu	Glu	Val	Asp	Gly	Lys	Lys	Ile	Met	Leu	Thr	Gly	Pro	Gln	Gln	Leu
	210				215						220				
Thr	Gly	Gln	Asn	Val	Val	Pro	Gly	Asp	Ile	Ser	Ser	Ala	Ala	Phe	
225				230					235					240	
Phe	Leu	Val	Ala	Gly	Leu	Val	Val	Pro	Asp	Ser	Glu	Ile	Leu	Leu	Lys
			245					250					255		
Asn	Val	Gly	Leu	Asn	Gln	Thr	Arg	Thr	Gly	Ile	Leu	Asp	Val	Ile	Lys
		260					265					270			
Asn	Met	Gly	Gly	Ser	Val	Thr	Ile	Leu	Asn	Glu	Asp	Glu	Ala	Asn	His
	275						280					285			
Ser	Gly	Asp	Leu	Leu	Val	Lys	Thr	Ser	Gln	Leu	Thr	Ala	Thr	Glu	Ile
	290				295						300				
Gly	Gly	Ala	Ile	Ile	Pro	Arg	Leu	Ile	Asp	Glu	Leu	Pro	Ile	Ile	Ala
305				310					315					320	
Leu	Leu	Ala	Thr	Gln	Ala	Thr	Gly	Thr	Thr	Ile	Ile	Arg	Asp	Ala	Glu
			325						330				335		
Glu	Leu	Lys	Val	Lys	Glu	Thr	Asn	Arg	Ile	Asp	Ala	Val	Ala	Lys	Glu
		340					345					350			
Leu	Thr	Ile	Leu	Gly	Ala	Asp	Ile	Thr	Pro	Thr	Asp	Asp	Gly	Leu	Ile
	355					360					365				
Ile	His	Gly	Pro	Thr	Ser	Leu	His	Gly	Gly	Arg	Val	Thr	Ser	Tyr	Gly
	370				375						380				
Asp	His	Arg	Ile	Gly	Met	Met	Leu	Gln	Ile	Ala	Ala	Leu	Leu	Val	Lys
385				390					395					400	
Glu	Gly	Thr	Val	Glu	Leu	Asp	Lys	Ala	Glu	Ala	Val	Ser	Val	Ser	Tyr
			405					410					415		
Pro	Ala	Phe	Phe	Asp	Asp	Leu	Glu	Arg	Leu	Ser	Cys				
		420					425								

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Figure 15N

ORF7

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atggaaagca ttgttttaaat tggtttcatt ggtgcgggta aaacaactat cggccaaagt 60
ttggccaata aactgaagat gcctcatctt gatttagata cagcgtaaat tgaaaaaata 120
ggacgctcaa ttcttgacta tttcgaaaaa tatggtgaag cagctttccg agaacaggaa 180
acccaacttt taaaggagct gtcaaaaaat acagccgtcc tttcaactgg gggcgggatt 240
gttgctcggac cagaaaatcg tagcttatta aaatcttttc agcaagtgat ttatttacat 300
gcgacaccag aagagctggt aaaaagaatc acagaagata ctgaaaacca acggccctta 360
gctatagaac gttcttcaaa agaaatcatt actttgtttg agtctcgtaa aaatttttat 420
gaagaatgtg cgaagatgac aattgatcgc accaatcgct cgccagaaga aattatcaat 480
gaaattctgc aacaattaaa ggagtag 507

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Figure 150

ORF7

Met	Glu	Ser	Ile	Val	Leu	Ile	Gly	Phe	Met	Gly	Ala	Gly	Lys	Thr	
1				5				10					15		
Thr	Ile	Gly	Gln	Ser	Leu	Ala	Asn	Lys	Leu	Lys	Met	Pro	His	Leu	Asp
		20						25					30		
Leu	Asp	Thr	Ala	Leu	Ile	Glu	Lys	Ile	Gly	Arg	Ser	Ile	Pro	Asp	Tyr
	35					40						45			
Phe	Glu	Lys	Tyr	Gly	Glu	Ala	Ala	Phe	Arg	Glu	Gln	Glu	Thr	Gln	Leu
50					55						60				
Leu	Lys	Glu	Leu	Ser	Lys	Asn	Thr	Ala	Val	Leu	Ser	Thr	Gly	Gly	Gly
65					70					75				80	
Ile	Val	Val	Gly	Pro	Glu	Asn	Arg	Ser	Leu	Leu	Lys	Ser	Phe	Gln	Gln
			85					90						95	
Val	Ile	Tyr	Leu	His	Ala	Thr	Pro	Glu	Glu	Leu	Leu	Lys	Arg	Ile	Thr
		100						105						110	
Glu	Asp	Thr	Glu	Asn	Gln	Arg	Pro	Leu	Ala	Ile	Glu	Arg	Ser	Ser	Lys
	115						120					125			
Glu	Ile	Ile	Thr	Leu	Phe	Glu	Ser	Arg	Lys	Asn	Phe	Tyr	Glu	Glu	Cys
	130					135					140				
Ala	Lys	Met	Thr	Ile	Asp	Thr	Thr	Asn	Arg	Ser	Pro	Glu	Glu	Ile	Ile
145					150					155				160	
Asn	Glu	Ile	Leu	Gln	Gln	Leu	Lys	Glu							
				165											

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Figure 15P

ORF8

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atgaaagtgt gttatttagg tccgattggt tcctttacgt acagtgcac gttggctgct 60
tttcctgaag ctacgttgat gccgtacgca tcgattccag cttgcttgaa agcaattgaa 120
cagcaagaag tggcatggag cattatccca atagaaaaca cgattgaagg aactgttaac 180
gcatcgatag attatttgta tcatcaagcg cagttacctg tccaagcaga gttagtttta 240
ccgattcaac aacaattaat ggtggcaaaa gagaatcaag cgatctggca acaaagtcag 300
aaaattttat cacatccgca agcattagct caatcgaga tgtttctaga gaaaaacttt 360
ccagaagcga ttttagaagc aacaccttca acagcttacg ccgccaata cattgcagaa 420
catccagaat taccttttgc agctattgca ccaaaacttt ctgcggaaat gtatgatttg 480
accattgttg aaaaaatat acaagattta tcggtaaatc aaacccgatt ttgggttctt 540
ggttctgaaa atttagcgat ttctttcccg ctatctgaga aaaaaataac actggcgatt 600
acgatgccaa gtaatgttcc tggtctctta caciaagtat taagcgtgtt tagttggcga 660
gggattaatc ttagcaaaat agaatcgcg ccgttgaaaa caaagctagg agagtacttc 720
tttttaatgg acttagtgaa agatcaacca gaaaaattaa ttgaagcagc cttaacagaa 780
ctggaactca ttggtgcaga aataaaaatt ttaggggatt acccgatcta tgttttgtcc 840
acactttaa

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Figure 15Q

ORF8

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Met Lys Val Gly Tyr Leu Gly Pro Ile Gly Ser Phe Thr Tyr Ser Ala
1      5      10      15
Thr Leu Ala Ala Phe Pro Glu Ala Thr Leu Met Pro Tyr Ala Ser Ile
20      25      30
Pro Ala Cys Leu Lys Ala Ile Glu Gln Gln Glu Val Ala Trp Ser Ile
35      40      45
Ile Pro Ile Glu Asn Thr Ile Glu Gly Thr Val Asn Ala Ser Ile Asp
50      55      60
Tyr Leu Tyr His Gln Ala Gln Leu Pro Val Gln Ala Glu Leu Val Leu
65      70      75      80
Pro Ile Gln Gln Gln Leu Met Val Ala Lys Glu Asn Gln Ala Ile Trp
85      90      95
Gln Gln Ser Gln Lys Ile Leu Ser His Pro Gln Ala Leu Ala Gln Ser
100     105     110
Gln Met Phe Leu Glu Lys Asn Phe Pro Glu Ala Ile Leu Glu Ala Thr
115     120     125
Pro Ser Thr Ala Tyr Ala Ala Lys Tyr Ile Ala Glu His Pro Glu Leu
130     135     140
Pro Phe Ala Ala Ile Ala Pro Lys Leu Ser Ala Glu Met Tyr Asp Leu
145     150     155     160
Thr Ile Val Glu Lys Asn Ile Gln Asp Leu Ser Val Asn Gln Thr Arg
165     170     175
Phe Trp Val Leu Gly Ser Glu Asn Leu Ala Ile Ser Phe Pro Leu Ser
180     185     190
Glu Lys Lys Ile Thr Leu Ala Ile Thr Met Pro Ser Asn Val Pro Gly
195     200     205
Ser Leu His Lys Val Leu Ser Val Phe Ser Trp Arg Gly Ile Asn Leu
210     215     220
Ser Lys Ile Glu Ser Arg Pro Leu Lys Thr Lys Leu Gly Glu Tyr Phe
225     230     235     240
Phe Leu Met Asp Leu Val Lys Asp Gln Pro Glu Lys Leu Ile Glu Ala
245     250     255
Ala Leu Thr Glu Leu Glu Leu Ile Gly Ala Glu Ile Lys Ile Leu Gly
260     265     270
Asp Tyr Pro Ile Tyr Val Leu Ser Thr Leu
275     280

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